

DTIC FILE COPY

②

Technical Report 725

AD-A178 671

**Annotated Bibliography of
Tactical Engagement Simulation 1966-1984**

Robert H. Sulzen



**ARI Field Unit at Presidio of Monterey, California
Training Research Laboratory**



**U. S. Army
Research Institute for the Behavioral and Social Sciences**

October 1986

Approved for public release, distribution unlimited

U. S. ARMY RESEARCH INSTITUTE FOR THE BEHAVIORAL AND SOCIAL SCIENCES

A Field Operating Agency under the Jurisdiction of the
Deputy Chief of Staff for Personnel

EDGAR M. JOHNSON
Technical Director

WM. DARRYL HENDERSON
COL, IN
Commanding

Technical review by

Mr. Charles Tallman
Office of the Director - Tactical Engagement Simulation
U.S. Army Training Support Center

Dr. Wayne D. Gray
Instructional Technology Systems Technical Area
U.S. Army Research Institute

NOTICES

DISTRIBUTION: Primary distribution of this report has been made by ARI. Please address correspondence concerning distribution of reports to U.S. Army Research Institute for the Behavioral and Social Sciences, ATTN: PERM-POT, 5001 Eisenhower Ave., Alexandria, Virginia 22333-5660

FINAL DISPOSITION: This report may be destroyed when it is no longer needed. Please do not return it to the U.S. Army Research Institute for the Behavioral and Social Sciences.

NOTE: The findings in this report are not to be construed as an official Department of the Army position, unless so designated by other authorized documents.

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER ARI Technical Report 725	2. GOVT ACCESSION NO. AD-A178671	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) ANNOTATED BIBLIOGRAPHY OF TACTICAL ENGAGEMENT SIMULATION 1966-1984		5. TYPE OF REPORT & PERIOD COVERED Final Report Period ending July 1986
7. AUTHOR(s) Robert H. Sulzen		6. PERFORMING ORG. REPORT NUMBER ---
9. PERFORMING ORGANIZATION NAME AND ADDRESS U.S. Army Research Institute Field Unit P.O. Box 5787 Presidio of Monterey, CA 93944-5011		8. CONTRACT OR GRANT NUMBER(s) ---
11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Army Research Institute for the Behavioral and Social Sciences, 5001 Eisenhower Avenue, Alexandria, VA 22333-5600		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS 2Q263743A794 511
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office) ---		12. REPORT DATE October 1986
		13. NUMBER OF PAGES 79
		15. SECURITY CLASS (of this report) Unclassified
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE ---
16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited.		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report) ---		
18. SUPPLEMENTARY NOTES ---		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Tactical Engagement Simulation TES Multiple Integrated Laser Engagement System MILES REALTRAIN Unit training		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) Tactical Engagement Simulation (TES) has greatly improved the effectiveness of tactical training. This report traces its history and provides an annotated bibliography. The history of this major training method--its requirement, concept, evolutionary development, and implementation--provides insights into requirements and processes for successful fielding of new training systems.		

Annotated Bibliography of Tactical Engagement Simulation 1966-1984

Robert H. Sulzen



Accession For	
NTIS CRA&I	<input checked="" type="checkbox"/>
DTIC TAB	<input type="checkbox"/>
Unannounced	<input type="checkbox"/>
Justification	
By	
Distribution /	
Availability Codes	
Dist	Avail and/or Special
A-1	

ARI Field Unit at Presidio of Monterey, California
Major Richard K. Williams, Jr., Acting Chief

Training Research Laboratory
Jack H. Hiller, Director

U.S. ARMY RESEARCH INSTITUTE FOR THE BEHAVIORAL AND SOCIAL SCIENCES
5001 Eisenhower Avenue, Alexandria, Virginia 22333-5600

Office, Deputy Chief of Staff for Personnel
Department of the Army

October 1986

Army Project Number
2Q263743A794

Education and Training

Approved for public release; distribution unlimited

ARI Research Reports and Technical Reports are intended for sponsors of R&D tasks and for other research and military agencies. Any findings ready for implementation at the time of publication are presented in the last part of the Brief. Upon completion of a major phase of the task, formal recommendations for official action normally are conveyed to appropriate military agencies by briefing or Disposition Form.

For several years, the Army Research Institute has been conducting research to help develop tactical Engagement Simulation, a tactical training method that has provided a quantum leap in training effectiveness. Although the method is relatively new, this report identifies over 200 references describing Tactical Engagement Simulation and its effectiveness.

The report will be helpful to tactical training researchers and developers in their review of the research and refinement of tactical engagement simulation. It will also be useful for military trainers and researchers working with field tactical training.

A handwritten signature in cursive script, appearing to read "Edgar M. Johnson".

EDGAR M. JOHNSON
Technical Director

EXECUTIVE SUMMARY

Requirement:

Tactical Engagement Simulation has had a profound effect on tactical training effectiveness. The history of its development, including its evolutionary changes, is documented only in a considerable but scattered literature. The objective of this review is to provide a source book concerning Tactical Engagement Simulation for researchers and training developers.)

Procedure:

Documents concerning Tactical Engagement Simulation were obtained from the research literature, military journals, and the open press. The documents were reviewed and an annotated bibliography prepared.

Findings:

More than 200 documents that were related to Tactical Engagement Simulation were found. These were categorized into eight topics: REALTRAIN, MILES (Multiple Integrated Laser Engagement System), National Training Center, training, leader training, support weapons, unit performance research, and motivation. Many of the documents describe the realism obtained when a believable system of casualty assessment is employed and present evidence for the very positive effects on participants in field exercise using the system.

Utilization of Findings:

This history of the development of a major training method--its requirement, concept, evolutionary development, and implementation--provides insights into the process and problems of training, development, and fielding. These can be of considerable value to researchers and developers of new training systems.

ANNOTATED BIBLIOGRAPHY OF TACTICAL ENGAGEMENT SIMULATION 1966-1984

CONTENTS

	<u>Page</u>
Chapter 1 INTRODUCTION	1
Chapter 2 REALTRAIN: EARLY TACTICAL ENGAGEMENT SIMULATION	5
Chapter 3 MILES: MULTIPLE INTEGRATED LASER ENGAGEMENT SYSTEM	9
Chapter 4 NTC: NATIONAL TRAINING CENTER	19
Chapter 5 HOW TO TRAIN WITH TACTICAL ENGAGEMENT SIMULATION	29
Chapter 6 LEADER TRAINING WITH TACTICAL ENGAGEMENT SIMULATION AS THE MEASURE OF PERFORMANCE	35
Chapter 7 SUPPORT WEAPONS IN TACTICAL ENGAGEMENT SIMULATION	39
Chapter 8 TACTICAL ENGAGEMENT SIMULATION FOR UNIT PERFORMANCE MEASUREMENT AND RESEARCH	43
Chapter 9 THE MOTIVATION PROVIDED BY TACTICAL ENGAGEMENT SIMULATION ..	59
BIBLIOGRAPHY	61

CHAPTER 1

INTRODUCTION

The purpose of this report is to provide a detailed sourcebook about a phenomenon that has revolutionized the tactical training of Army units in force-on-force exercises. The documents reviewed included government and contract reports as well as articles in military publications and the open press. Some documents that have not had wide circulation are also included because they provide some useful information not otherwise available.

Tactical Engagement Simulation, for the purpose of this document, is defined as a training methodology which simulates land combat by providing weapons signatures, weapons effects (realistic casualty assessment to include an effective control system), and psychological effects (through competition and stress). To be effective, the weapons simulation must be used in combination with good training methods. This includes a control system which enforces the rules of engagement to ensure realism. The control system can also provide other essential ingredients like a scenario designed to achieve the training objectives, a procedure to gather information about performance, and a means of providing feedback to the participants on their actions in the form of an After Action Review (AAR).

Although the author has been associated with Tactical Engagement Simulation for a decade, he does not fully know the history of its development. Even those who were more involved in the initial concepts have differed widely in their perceptions of the same events when interviewed by the author. This document is not a history of the development of Tactical Engagement Simulation, but an annotation of documents found by the author during his tenure of research in the area. However, at the urging of one colleague, the following brief outline of major events is offered for some historical perspective.

Anyone who has played the childhood games of "cops and robbers" or "cowboys and indians" knows the desire for a foolproof "gotcha." Clearly, the military have sought a device that would provide a weapons "gotcha" or means of objective casualty assessment for both training and research. In addition to this general movement for assessing individual weapons effects, there were two other major threads of history that led to the full development of Tactical Engagement Simulation. One of these was the Board for Dynamic Training and the other was the National Training Center (NTC).

The origins of Tactical Engagement Simulation can be traced to the search for an objective means of casualty assessment. The chapter on MILES (Multiple Integrated Laser Engagement System, see Chapter 3) documents this search from the mid 1960s, discussing the feasibility of using laser technology for

scoring weapons effects. Sometime during this era, the Simfire (Wilson, 1980) and other similar devices were developed for tank gunnery training using laser technology for producing simulated tank casualties. In the early 1970s, test agencies developed and used similar devices for research (Combat Developments Experimentation Command, 1974a; Modern Army Selected System Test Evaluation and Review, 1975). However, these devices were relatively expensive.

In 1971 the Board for Dynamic Training headed by General Paul Gorman was formed by the Army Chief of Staff to improve the status of Army training. The board made a number of recommendations including a training device for direct fire simulation and the formation of a Combined Arms Training Board (CATB). CATB was formed and produced three submovements which aided in the promotion of realistic training: the Tactical Engagement Simulation Directorate, MILES development, and NCO proficiency measurement research.

The Tactical Engagement Simulation Directorate of the Army Training Support Center (Fort Eustis, Virginia) was formerly the TRADOC Systems Manager for Tactical Engagement Simulation, and before that the Program Manager for Engagement Simulation. This office was originally a part of CATB (Fort Benning, Georgia) responsible for the development of MILES and the control and training system that supports Tactical Engagement Simulation training.

The development of MILES stemmed directly from the training device recommendations of the Board for Dynamic Training and research on the feasibility of a low-cost weapons scoring device for tactical training conducted by Arthur D. Little, Incorporated (1973). However, the developmental process was lengthy and did not produce a device for Army-wide use until the early 1980s.

The research on NCO proficiency measurement produced SCOPES (Squad Combat Operations Exercise [Simulation]) which was a means of Tactical Engagement Simulation using small rifle scopes and controller judgement for casualty assessment. Although developed originally as a means of measuring NCO proficiency, General William DePuy (the first TRADOC Commander) saw the potential of SCOPES as a training methodology and directed Army-wide implementation. Continued research, after being redirected away from NCO proficiency measurement, led to the development of REALTRAIN (Realistic Training) for tank and antitank weapons and the training and control systems which are the heart of effective Tactical Engagement Simulation training.

The development of the National Training Center seems to have had its origins in a concept paper prepared by General Gorman in 1976. He had been influenced by the Air Force development of Red Flag. Red Flag was a training facility at Nellis Air Force Base, Nevada that simulated the combat environment for fighter pilots by providing an aggressor squadron (pilots trained in Warsaw Pact tactics) and ground targets. The Red Flag concept had grown out of the Navy fighter pilot training program called TOPGUN.

This report is divided into chapters to facilitate review of common topics. The topics are REALTRAIN, MILES, National Training Center, training, leader training, support weapons, unit proficiency measurement and research, and motivation. Each chapter is organized chronologically so that

developments may be followed more or less historically. The bibliography concluding the report lists each document reviewed alphabetically.

The approach taken for annotation was to review the documents for sections dealing with Tactical Engagement Simulation and abstract that portion for the reader. In the case of research documents, the approach and findings sections are summarized. The author provided his views about documents he considered to be particularly important or of limited usefulness.

CHAPTER 2

REALTRAIN: EARLY TACTICAL ENGAGEMENT SIMULATION

REALTRAIN (realistic training) was the first of the Tactical Engagement Simulation techniques implemented and widely used by Army units for tactical training. The documents reviewed in this chapter are those that describe REALTRAIN and those that were instrumental in its development. At the time most of these documents were written, there was a need to convey what the system was like and how it worked. The annotations include reference to documents in other chapters. The methodology for training with REALTRAIN is contained in Chapter 5. The measurement and research documents not listed below can be found in Chapter 8.

Mathers, Boyd L., Shriver, Edgar L., Root, Robert T., Word, Larry E., Whitter, David W. and Griffin, Glenn R. Training Manager's Handbook for Situational Training. Final Contract Report for ARI, Contract DAHC 19-73-C-0017, November 1973.

This document is a guidebook on how to conduct "situational training," which later became SCOPES and REALTRAIN. This document and the contract report describing the developmental research for individual testing (Hayes, Griffin, and Mathers, 1974) became the basis for the pamphlets on SCOPES (US Army Infantry School, 1973), REALTRAIN (US Army Armor School, 1975), and a general research report (Shriver, Mathers, Griffin, Jones, Word, Root, and Hayes, 1975).

Hayes, John F., Griffin, Glenn R. and Mathers, Boyd L. Development of Performance Based Proficiency Tests for Combat Arms Skills. Final Contract Report for ARI, Contract Number DAHC 19-73-C-0016, May 1974.

The research covered in this report led to the development of SCOPES and REALTRAIN, however, the original intent was to develop proficiency tests for squad leaders and tank commanders. The report provides the rationale for the development of the tests and the detailed tests as appendices. The tests were never used for their intended purpose due to the problems of standardization of test situation and the difficulty and cost of field testing. (See also Pulliam and Mathers, 1976, and Mathers, Shriver, Root, Word, Witter, and Griffin, 1973.)

MacFarlane, Douglas E. "SCOPES: My Introduction," Infantry, Volume 64, Number 5, September-October 1974, pp. 29-31.

This is an article about the Squad Combat Operations Exercise (Simulation) or SCOPES, an early version of Tactical Engagement Simulation for rifle squads. One of the author's rifle platoons was selected for SCOPES training,

and he was highly skeptical of the training value. When he observed and participated himself in the exercises, he had to admit it was the best training he had ever seen in the Army.

Anderson, John and Sherwood, Edward. "REALTRAIN" Infantry, Volume 65, Number 1, January-February 1975, pp. 20-23.

A description of the problems in contemporary Army training that justified a means of including weapon's lethality in tactical field training is presented. ARI is credited with developing in 1973 the SCOPES system for rifle squads (see McFarlane, 1974) and continuing that development with the Infantry and Armor Schools for mechanized infantry and tank platoons. The casualty assessment techniques employing telescopes and plastic sighting plates are mentioned along with the After Action Review method of using a guided discussion to learn battle lessons. The system is credited with helping to achieve higher levels of tactical proficiency, and a series of questions and answers about the system conclude the article.

Shriver, Edgar L., Mathers, Boyd L., Griffin, Glenn R., Jones, Donald R., Word, Larry E., Root, Robert T. and Hayes, John F. REALTRAIN: A New Method for Tactical Training of Small Units. ARI Technical Report S-4, December 1975.

This is the first report from the research community on Tactical Engagement Simulation including a description of SCOPES and REALTRAIN and the field trials that were conducted as a part of the developmental effort. The REALTRAIN training model (exercise, after action review, analysis, and repeat exercise) development and underlying principles are presented. Preliminary results are presented from field trials at Wildflecken Germany as suggestive of the improvement in tactical skill and positive troop attitudes that result from repeated and realistic simulated combat training.

Gorman, Paul F. "Engagement Simulation," First International Learning Technology Congress & Exposition on Applied Learning Technology, Proceedings Volume IV, Society for Applied Learning Technology, Washington, DC, July 1976a, pp. 13b-141.

This presentation summarizes Tactical Engagement Simulation as a means of providing tactical training that sums the component combat skills into an effective whole. The advantages of engagement simulation over blank fire and live fire training are presented. The development of SCOPES, REALTRAIN, and the coming of MILES are detailed. The report concludes with a selected summary of the results of the REALTRAIN Validation in Europe (Root, et al, 1976).

Word, Larry E. and Root, Robert T. Tactical Engagement Simulation: Experimental Learning. Army Training Support Command Pamphlet, June 1977.

This is a short document listing the advantages of Tactical Engagement Simulation (TES) training. The disadvantages of live fire and blank fire exercises are compared with the advantages of two-sided, free-play TES exercises. TES exercises provide an environment where soldiers may learn by doing (experiential learning) or from experience reinforced by the After Action Review. Test results from the EFFTRAIN Project (Root, Hayes, Word,

Shriver, and Griffin, 1979) and the USAREUR REALTRAIN Validation (Root, et al, 1976) support the advantages of the training. The Multiple Integrated Laser Engagement System (MILES) is presented as the future TES system especially for company and battalion level training.

Harvey, Charles. "Pound Foolish?" Infantry, Volume 69, Number 5, September-October 1979, pp. 37-38.

This is an article which advocates making use of the results of the REALTRAIN validation research series (Banks, Hardy, Scott, Kress and Word, 1977; Meliza, Scott, and Epstein, 1979; and Scott, Banks, Hardy, and Sulzen, 1979) supporting the use of Tactical Engagement Simulation in training, even at the cost of the small economies to be gained through conventional training. These false savings are largely in the form of less training time for controllers and fewer controllers (for commander attitudes, see also Camm, 1978).

Sutterlin, Walter J. "REALTRAIN," Infantry, Volume 69, Number 5, September-October 1979, pp. 35-37.

This article is a practical "how to do it" guide for troops planning to conduct REALTRAIN exercises and an endorsement of the benefits of this type of training until MILES would be issued to units. A discussion of the importance of realistic casualty assessment is provided. This article is one of the few reviewing the training benefits received by the controllers.

Sulzen, Robert H., Word, Larry E. and Loftis, Donald D. A Tryout of Engagement Simulation Training Techniques for Rifle Squads and Platoons. Working Paper SS/TA-80-1, June 1980.

This report documents the development of a Tactical Engagement Simulation training method where the personnel resources of one rifle company, supplemented with additional battalion radics, were employed in rifle squad and platoon training as both players and controllers. In previous research the control staff had been dedicated to control and had not had the responsibility to rotate between controller and player. The three platoons trained were compared with three untrained platoons in attack and defend exercises. The trained platoons successfully accomplished all defensive missions and two of the three offensive missions. The offensive missions were only accomplished with heavy casualties. Military observers were of the opinion that more training was required for successful offensive performance.

MILES: Multiple Integrated Laser Engagement System

Weapons simulation with laser technology was first conceived for force development experiments and for gunnery training. The Board for Dynamic Training proposed a weapon scoring system, and initiated development of the system that eventually became MILES. The documents reviewed chronologically in this chapter include those concerning MILES, force development experiments, and gunnery trainers. As in the last chapter, annotations cross reference documents in other chapters: Chapter 5 for MILES training and Chapter 8 for measurement and research. Included in this chapter are three documents on eye safety research.

Gardiner, K. W., Fraser, E. C., Pressman, G. L. and Northend, C. A. Direct Fire Simulation System. Final Contract Report for CDEC, Contract DA-04-200 AMC-1884 (X), October 1966.

This document reports on the design of a system which simulates effects of direct fire weapons permitting two-sided, free-maneuver, field experimentation with live troops on both sides. One recommendation was the use of either a microwave beam or laser beam technique for the direct fire simulator system.

Board for Dynamic Training. Training Techniques and Devices Considered by Administrative Committee. Final Report, Volume VI, Annex J (Committee Reports), December 1971, pp. J-919 to J-942.

This small section of one volume of the board report contains the two training device recommendations (tank hit-kill indicator, p. J-934, rifle hit-kill indicator, p. J-936) that resulted in the technical report (Arthur D. Little, Inc., 1973) which determined MILES to be feasible.

Arthur D. Little, Inc. Technical Evaluation of Four Dynamic Training Devices. Final Contract Report for US Army Combat Arms Training Board, Contract Number DAHG 19-72-C-0032, February 1973.

A technical review of four proposed training devices, one of which was the first detailed concept for MILES and coined the first MILES acronym (at that time Multiple Integrated Laser Engagement Simulator, later the last word changed to System). The effort was based on the report by the Board for Dynamic Training (1971) and the Combined Arms Training Board (CAT-B, the successor to the Board for Dynamic Training) calling for training devices that would increase realism in tactical training. The report concluded that man vs. man, tank vs. tank, and antitank vs. tank engagements were feasible with present technology at an affordable cost. For the system to be successful, the report recommended that the devices be designed for ruggedness and reliability, minimum effect on weapon handling, and ease of boresighting by troops.

Modern Army Selected Systems Test Evaluation and Review (MASSTER). Official Weapons Engagement Scoring System (WESS) Mini Test, MASSTER Test Report, June 1975.

This document is a follow on test report of a Tactical Engagement Simulation system developed for MASSTER (now TRADOC Combined Arms Test Activity [TCATA]) to provide laser hit/kill scoring. The initial test found deficiencies in the system, and this report outlines the next test results without stating acceptance. However, the WESS was used subsequently by MASSTER and later TCATA (see Blalock and Mullis, 1976).

Tice, Jim. "Safe Laser Eyed As New Tool for Tactical Training," Army Times, 8 March 1976, p. 26

This article documents the establishment of a TRADOC Program Manager for Engagement Simulation and provides a description of SCOPES, REALTRAIN, and the coming of MILES. The MILES concept is described and the plans for test models by early 1978 (MILES Operational Test II was actually conducted in the Fall of 1978).

TRADOC'S Program Manager for Engagement Simulation. TRADOC's Engagement Simulation Research and Development Program. US Army Combat Arms Training Board, Fort Benning, Georgia, March 1976.

This document is a status report on Tactical Engagement Simulation as of the Spring of 1976. It includes a review of the training model (Shriver, Mathers, Griffin, Jones, Word, Root, and Hayes, 1975), the planned research and development, planned field implementation support, and a series of annexes including: selected readings on engagement simulation, the MILES development schedule, indirect fire simulation, and leader training systems.

Hardy, Guthrie D. "Trip Report - Exercise Brave Shield XIV, Yakima Firing Center, Washington," Memorandum for File, ARI Field Unit, Presidio of Monterey, September 1976.

This trip report provides observations that are consistent with other reviews of Brave Shield XIV which indicate that it was a poor implementation of Tactical Engagement Simulation. Some of the identified problems included the following: only selected systems were equipped with the Tactical Engagement Simulation device called a Weapon Effects Scoring System (WESS), signature simulation was not played except for 50 caliber machineguns, controllers did not have their own transportation, the controllers were given only one hour of instruction on the system/did not know how to activate it, many of the WESS devices were inoperative, and civilian maintenance technicians were present only for limited periods. (See also Word, 1976 and Rice and Woodruff, 1976.)

Word, Larry E. "Observations on the Use of TACTA WESS Device in Brave Shield XIV," Memorandum for BG Pearson, TRADOC, September 1976.

This memorandum presents the problems that occurred during an attempt to implement Tactical Engagement Simulation in a large scale exercise (Brave Shield XIV) using a device similar to MILES. The problems observed included: lack of realism due to unequipped player invulnerability,

insufficient control personnel, and poor maintenance of devices. (See also Hardy, 1976 and Rice and Woodruff, 1976.)

Black, Ira W., Blalock, Darrell N., Bosma, Phillip H., Mullis, Harry E., McDonald, Jerome P. and Fleisher, Kenneth E. Three-Tank Platoon Versus Five-Tank Platoon. TRADOC Combined Arms Test Activity (TCATA) Test Report Number TT 1085, November 1976.

This document is a report on a test comparing tank platoons composed of either three or five tanks. The results favor the three tank platoon configuration, but are no longer of interest (the J-series reorganization going into effect will have a four tank platoon). Three of the four tests conducted employed the WESS (Weapons Engagement Scoring System) which is able to determine casualties, much as the MILES does (for details on WESS, see Modern Army Selected Systems Test Evaluation and Review, 1975). Although lengthy, this report has some important observations on Tactical Engagement Simulation that may be gleaned. For instance, the observation that there was a dramatic learning effect from one exercise to the next, that crews conducted their own critique after each exercise to correct errors, and that specific tactics and techniques were effective or ineffective. Inclosure six of the report is a wellspring of lessons learned from exercises. Many of the lessons learned from this test are documented in a report by Blalock and Mullis (1976).

Blalock, Darrell N. and Mullis, Harry E. Impact of Realism in Field Exercises. TRADOC Combined Arms Test Agency observations from the Three-Tank versus Five-Tank (3x5) Test, November 1976.

A summary report based on the 3x5 test (Black, et al, 1976) which is related to training and tactical techniques growing out of Tactical Engagement Simulation or realistic tactical training. Some of the observations included the improved use of terrain, selection of firing positions, position enhancement with a dismounted crew member, techniques for breaking contact, selection of covered and concealed withdrawal routes, and the development of a volley-fire technique.

Rice, Charlie W. and Woodruff, Charles L. Weapons Engagement Scoring System (WESS) Brave Shield XIV. TRADOC Combined Arms Test Activity (TCATA) Test Report Number TEP 2024, November 1976.

This report evaluates the use of the Weapons Engagement Scoring System (WESS) as a tactical training device during a field training exercise. The usual control system found to be necessary during Tactical Engagement Simulation exercises was not employed, specifically: individuals were allowed to turn off the power to the WESS, cover the detectors rendering them invulnerable, turn off the kill indication system; the rules of engagement were not followed and killed vehicles were allowed to immediately reenter play; and finally, insufficient control personnel were provided to support the usual control system.

Beatrice, Edwin S., Lund, David J., Cours, David, Wampner, Paul and Sliney, David H. Project MILES: Biomedical Research and Coordination in Safe Field Exercises. Proceedings of Army Science Conference, Volume One. West Point, New York, June 1977, pp. 95-103.

A technical report on experiments conducted to determine if the Multiple Integrated Laser Engagement System (MILES) was safe for field use. The report states that there is justification for modifying the regulations which would permit MILES to be classified as eye-safe.

Munera, Antonio, III. The Multiple Integrated Laser Engagement System (MILES) and the TOW ARTEP. A Thesis presented to the Faculty at the US Army Command and General Staff College in Fort Leavenworth, Kansas, June 1977.

This thesis provides a summary of the plans at that time for the development and fielding of the Multiple Integrated Laser Engagement System (MILES) and the problems with the Army Training and Evaluation Program (ARTEP) as related to the Tube-launched Optically-tracked Wire-guided missile (TOW) squad and section. The author submitted a proposed ARTEP which included the use of MILES to refine gunner tracking techniques, pinpoint defensive positions, check range cards, check fire control techniques, and establish a pass/fail criterion for two-sided engagements.

Kress, Gary, Bradshaw, Stephen C., McFarland, Robert L. and Ashley, Jerry L. ARI Prototype Small Gun Laser Engagement System. ARI Technical Paper 318, November 1978.

This is a report on the feasibility of developing a small gun laser engagement system for field research purposes. Three subsystems were developed: a laser transmitter mounted on the M-16 rifle, a helmet-mounted laser receiver, and an off-line computer which received data from the receiver memory, reformatting the data, and performed data reduction analysis. Although the system was found to be feasible, it was never developed in quantity. (For a system that is compatible with MILES and will accomplish the objectives of this system, see Keating and Gamarino, 1983.)

Milhorn, Charles L. and Manza, Peter F. Independent Evaluation Report of the Operational Test II for the Multiple Integrated Laser Engagement System (MILES). Combined Arms Training Developments Activity (CATRADA) Final Report ACN47417, February 1979.

This document reports on the evaluation of MILES during the Operational Test II (OT II). During this test many of the systems were found to be unacceptable in terms of reliability, availability, and maintainability (RAM). A human factors survey indicated that soldiers, leaders, and trainers utilizing the MILES equipment were enthusiastic about its use. Although the logistics support material was found to be acceptable, the logistical support could not be evaluated since no data were available on times for turn in, reinventory and reissue, or on the problems associated with a higher density of MILES equipment. The training support package was judged adequate for the operation, installation, and maintenance of the MILES equipment. Although some negative training can result from MILES training (e.g., gunnery training), MILES "has the potential to revolutionize and revitalize training of the combined arms team." The report concludes that further testing is required before the system is implemented. (Further testing was conducted during MILES OT III in the Fall of 1979, and the system was found satisfactory at that time; see also TRADOC Combined Arms Test Activity, 1979.)

Siller, William O. Development Test II (PQT-G) of Multiple Integrated Laser Engagement System (MILES). Material Testing Directorate, Aberdeen Proving Grounds Final Report, February 1979.

This document reports the results of the second development test of the Multiple Integrated Laser Engagement System (MILES). The purpose of the test was to provide the data required for an independent evaluation to determine if the MILES was a safe and effective training device ready for full-scale production. The report contains a list of deficiencies and suggested improvements.

Stromvall, Steve. "The Real Thing," Soldiers, Volume 33, Number 2, February 1979, pp. 9-11.

This article describes Tactical Engagement Simulation as it was at the time of the report. SCOPES, REALTRAIN, and MILES are each briefly reviewed as means of adding realism to the field training exercises (FTXs). The article also reviews the Opposing Force (OPFOR) concept and plans for training units at Fort Irwin, California (which has since become the National Training Center).

Wilde, Robert L. Small Force Engagement Experimentation. Report SAND 79-2473. Sandia Laboratories, Albuquerque, New Mexico, February 1979.

This report documents the first use of the Multiple Integrated Laser Engagement System (MILES) for training. The Department of Energy (DOE) had a Transportation Safeguards System that required evaluation. Original plans were to make use of the CDEC instrumented range, but Army priorities postponed availability and an alternative was sought. MILES became the alternative and the system is described along with the development of a test methodology and a suggestion the system could be used for effective training. (See also Wilde, 1981.)

TRADOC Combined Arms Test Activity. Multiple Integrated Laser Engagement System (MILES) Operational Test II (MILES OT II). TACATA Final Report OT 210, May 1979.

This document reports on the results of the second operational test of the Multiple Integrated Laser Engagement System (MILES). Trainers and soldiers were generally positive in their opinion of MILES and its contribution to their combat readiness. There were enough problems with the equipment that one recommendation of the report was that another operational test be conducted. (See also Milhorne, 1979.)

Loftis, Donald D. "MILES," Infantry, Volume 70, Number 1, January-February 1980, pp. 42-44.

This article describes the Multiple Integrated Laser Engagement System (MILES) and provides a brief description of operational testing and the training benefits derived from the testing. The article concludes with a recommendation for a higher emphasis of training readiness employing MILES in the ART&P and at the National Training Center as a part of Army training policy.

Hofer, Ronald C. "Training Devices for the Army," National Defense, Volume 64, Number 358, February 1980, pp. 24-27 & 47.

This is an article reviewing Army training devices developed including the Multiple Integrated Laser Engagement System (MILES).

Wilson, Michael W. "Simfire -- Tank Gunnery and Tactical Simulation," National Defense, Volume 64, Number 358, February 1980, pp. 28-31.

This article is about a British developed laser gunnery trainer which may also be used for Tactical Engagement Simulation training with a 1980 price tag of about \$25,000. The device has many of the advantages of similar devices developed by other countries, all of which may be candidates for the Tank Weapon Gunnery Simulation System (TWGSS, see Ruegamer, 1982 and US Army Armor Center and Fort Knox, 1983). Simfire and other gunnery devices have a higher price tag than MILES and are vehicle versus vehicle systems without provision for dismounted infantry.

Zuclich, Joseph A., Tredici, Thomas J., Mikesell, George W., Gibbons, William D. and Schmidt, Robert E. MILES Device Ocular Hazard Evaluation. USAF School of Aerospace Medicine Report SAM-TR-80-2, Brooks Air Force Base, Texas, March 1980.

This report was conducted based on the findings of an earlier report (Beatrice, Lund, Cours, Wampner, and Sliney, 1977) where retinal clouding was associated with exposure to MILES. The test conducted could not reproduce the retinal clouding of the earlier test, and, since the conditions employed in the test were considerably more severe than any which would be encountered in the field, it was concluded that no identified ocular hazard is associated with MILES M-16 Rifle Laser Transmitter.

Glasgow, Matt. "Quick or Dead? MILES Tells Which One You'll Be," Soldiers, Volume 35, Number 7, July 1980, pp. 11-12.

This is an article informing soldiers about the Multiple Integrated Laser Engagement System (MILES), how it works, plans for its use at the National Training Center, and its expansion for helicopters and air defense weapons (see Chapter 7).

Garamone, Jim. "Laser Combat," The Pentagon News, 26 March 1981, pp 20-21.

This article is a photo-journalistic review of platoon Army Training and Evaluation Program (ARTEP) evaluations making use of Tactical Engagement Simulation with the Multiple Integrated Laser Engagement System (MILES). This article was compiled while the Combat Operations Training Effectiveness Analysis Model (COTEAM) evaluation was being conducted (Sulzen, Hannaman, Freeble, and Laurence, 1981). (For a similar article see also, Hines, 1981.)

Hines, Paul. "Old Guard Takes to Woods for Laser War ARTEP," Army Times, 13 April 1981, pp. 16-17.

This article is a photo-journalistic review of platoon Army Training and Evaluation Program (ARTEP) evaluations making use of Tactical Engagement Simulation with the Multiple Integrated Laser Engagement System (MILES). This article was compiled while the Combat Operations Training Effectiveness Analysis Model (COTEAM) evaluation was being conducted (Sulzen, Hannaman,

Freeble, and Laurence, 1981). (For a similar article, see also Garamone, 1981.)

"Laser Bullets Score a Hit in the Battlefield Training," The Pentagon News, 21 May 1981, p. 15.

This article is a description of the Multiple Integrated Laser Engagement System (MILES) and its advantages for army training. The procurement and initial issue of the devices is presented.

Glasgow, Matt. "Troops Go for MILES," Soldiers, Volume 36, Number 6, June 1981, pp. 49-52.

This is an article describing soldier enthusiasm for the Multiple Integrated Laser Engagement System (MILES) when it was first issued to units in 1981. There are several quotes of soldier endorsements and anecdotal accounts of MILES use by troops in the field.

Lund, David J., Stuck, Bruce E. and Beatrice, Edwin S. Biological Research in Support of Project MILES. Letterman Army Institute of Research Report Number 96, Presidio of San Francisco, California, July 1981.

This is a technical report on experiments conducted to determine if the Multiple Integrated Laser Engagement System (MILES) was safe for field use. The report states that there is justification for modifying the regulations to permit MILES to be classified as eye-safe. However, a subtle retinal effect called "retinal clouding" was induced by exposure to low level gallium arsenide laser (the type used in MILES). (See also, Beatrice, Lund, Cours, Wampner, and Sliney, 1978 and Zuclich, Tredici, Mikesell, Gibbons, and Schmidt, 1980).

Commander's Guide to Tactical Engagement Simulation with MILES, Pamphlet, approximately Fall 1981.

This document was developed for division, brigade, and battalion commanders to familiarize them with the implementation of MILES. It provides an introduction to MILES and Tactical Engagement Simulation. It also describes how to integrate the training into the overall training program and emphasize the important role field commanders play.

Wilde, Robert L. "Tactical Training for Security Personnel," Sandia Technology SAND 81-1813, Sandia National Laboratories, Albuquerque, New Mexico, Volume 5, Number 7, December 1981, pp. 16-27.

This report documents the development of MILES training for the Department of Energy (DOE) and the improvements made for small arms training in the system. These improvements could be employed by the Army for increased fidelity of the light infantry MILES training. The improvements include a laser diffraction insert which will make realistic hits at less than 25 meters (presently MILES does not), a light-activated transmitter (better performance than the MILES acoustic microphone), a miniature transmitter for pistols, a special blank-fire adapter that will not allow a live round to chamber/causes the weapon to climb with automatic fire, and changes in the detectors. (See also Wilde, 1979.)

Johnston, Rico. "MILES: A Laser System that Lets Soldiers Make their Mistakes and Learn from them Before they Play for Keeps," Army Trainer, Volume 1, Number 2, Winter 1981-1982, pp. 26-28.

This is an article with a description of the Multiple Integrated Laser Engagement System (MILES) as used in the Army. There are also a number of comments from the field concerning the use of MILES including the following: modify the placement of the leader in the wedge formation or he will be the first casualty; suppressive fire is not effective unless it is aimed; individuals do not operate as buddy teams communicating with each other, and troops bunch up and become casualties in the same area.

Department of the Army, Headquarters, 2d Brigade, 3d Armored Division, "MILES Sniper After Action Report," 3d Armored Division Letter Report, March 1982.

This document is an after action report on the use of the Multiple Integrated Laser Engagement System (MILES) to teach the fundamental sniper employment techniques. The program training objectives are given and the results of a tryout -- which indicated that the goals of the program had been met in the view of the developers. The developers also wrote an "Infantry" magazine article (Rogers and Hackney, 1983).

Keating, John M. and Gamarino, Rudolph R. "An Advance Combat Training System Using Laser Simulation," National Defense, May-June 1982, pp. 31-32 & 38.

This is an article on a newly developed Tactical Engagement Simulation technique employing a system that also produces a record of which system was firing when and which system was hit. The new system is compatible with the Multiple Integrated Laser Engagement System (MILES) and provides detailed chronological information for improved training or research purposes. The man-worn system has 35 detectors versus the 13 on the MILES man-worn system, however, the additional cost is substantial. (See also Keating and Gamarino, 1983.)

Tools for the Trainer. "MILES Training Support Materials," Army Trainer, Volume 1, Number 4, Summer 1982, p 60.

This brief article includes a listing of MILES training publications and video tapes.

Ruegemer, Alan E. Concept Evaluation for the Tank Weapon Gunnery Simulation System (TWGSS). US Army Armor and Engineer Board Final Report TRADOC TRMS Number O-CEP034, November 1982.

This document is a report on the feasibility of using a Tank Weapon Gunnery Simulation System (TWGSS) Candidate to train gunnery skills in range situations and during field exercises. The candidate system provided tracer sensory cues to the crew for low and medium velocity ammunition when the main gun was fired. Although this system could also be used in field training exercises, it would provide better gunnery training than the Multiple Integrated Laser Engagement System (MILES) but at a greater cost. (See also US Army Armor Center and Fort Knox, 1983.)

Stout, Michael A. "Squad Leader's Combat Laser Course," Soldiers, Volume 2, Number 1, Fall 1982, pp. 44-45.

This article is a brief description of the Multiple Integrated Laser Engagement System (MILES) and one unit's use of the system for rifle squads and squad leaders. The use in this case is a course or exercise lane for squads where learning takes place through repetitions. The course includes mock ups of destroyed buildings and disabled BMPs. The author claims benefits in terms of unit cohesion, leadership training, combat drill, and physical training. (See also Robertson, 1982.)

Keating, John M. and Gamarino, Rudolph R. "Laser Battlefield Simulation Reaches New Levels of Sophistication," Military Electronics/Counter-measures, February 1983, pp. 40-42.

This is an article on a newly developed Tactical Engagement Simulation system which lists 34 detectors instead of 35 (Keating and Gamarino, 1982) on a man-worn system. This article also includes information on a controller unit used by umpires similar to the MILES control gun, except it can be used to set the clock on the man-worn system, check weapon identification numbers, and send reset messages to player systems.

Training Newsbriefs "Abrams Enters MILES Battlefield," Army Trainer, Volume 2, Number 3, Spring 1983, p.12.

This is a brief article on the testing and acceptance of MILES devices for the new M-1 Abrams tank.

Gray, Wayne D. "Engagement Simulation: A Method of Tactical Team Training," Training and Development Journal, Volume 37, Number 7, July 1983, pp. 29-31, 33-34.

This article is a description of Tactical Engagement Simulation as the solution to a training problem. The article includes casualty assessment with MILES, the development of training objectives for tactical training, and the post-exercise discussion (After Action Review).

Tips from the Trenches, "MILES Video Tapes," Army Trainer, Volume 2, Number 4, Summer 1983, p. 47.

This brief article includes a listing of the video tapes available from the TASC on MILES equipment and training.

US Army Armor Center and Fort Knox. Tank Weapons Gunnery Simulation System (TWGSS). Directorate of Training and Doctrine Fact Sheet, November 1983.

This fact sheet describes the Tank Weapons Gunnery Simulation System (TWGSS) which is a program to develop a training device that will be installed on tanks to provide both a MILES-compatible and gunnery training capability. The gunnery training capability will take into account lead, super-elevation, range, ammunition type, obscuration at firing, sight displacement, and target effects. The device will superimpose a simulated tracer and impact indication on the sight and will provide a hard copy record of engagement parameters for training and evaluation purposes. The research contract award is planned for

FY 85 with an initial operational capability in FY 87. (See also Ruegemer, 1982.)

Actkinson, Tomme R. Human Factors Evaluation of the Multiple Integrated Laser Engagement System in an Operational Environment. ARI Research Report 1322, November 1980.

An evaluation of human factors during the second operational test of MILES (Fall 1978) was made by gathering data on user acceptance and the man-machine interface of the MILES equipment. Results indicated a high degree of user acceptance for MILES as a training system. The MILES equipment was found to be easy to install and remove. The checkout procedures for the Dragon and Viper devices were overly complex. The MILES TOW system had a major safety hazard due to unintentional discharges of the ATWESS.

The National Training Center (NTC) became a reality at Fort Irwin, California after the Army reviewed the Air Force development of a training center called Red Flag. The NTC makes heavy use of Tactical Engagement Simulation with MILES, but adds some of the benefits of the type of instrumentation used in force development tests. However, the NTC staff emphasizes that their major mission is training and not testing.

The documents reviewed and the cross reference techniques used are similar to those in previous chapters. Two references are for background information only: Skinner (1984) reviews the Air Force's Red Flag and Mancus (1982) presents the Navy's Topgun program (both of these efforts contributed to the National Training Center concept).

Gorman, Paul F. Toward a Combined Arms Training Center. TRADOC Concept Paper, November 1976b.

The paper recounts the US Air Force development of Red Flag Training at Nellis Air Force Base in Nevada as a result of poor performance in air-to-air combat in Viet Nam. Red Flag provides a realistic simulation of air-to-air combat making use of the relatively uninhabited area of the Nevada desert and a well trained aggressor squadron of pilots who present threat tactics. The paper proposes a similar type of training for the Army making use of Fort Irwin, California with a trained opposing force using threat tactics, and the Multiple Integrated Laser Engagement System (MILES). This paper was undoubtedly the forerunner of the National Training Center.

Combat Developments Experimentation Command. Training Instrumentation Evaluation (TIE). Final Report on CDEC Experiment FC 095, December 1978.

This document reports on the effort to provide baseline information on Tactical Engagement Simulation in an instrumented environment to aid in planning for the National Training Center (NTC). This study was also used by the office of the TRADOC Systems Manager for Tactical Engagement Simulation (TSM-IES) to test out a MILES control system implemented during MILES OT II. Player personnel identified the following types of feedback as useful: a chronology of exercise firing events, position location on a map overlap photo, an animated, map-based motion picture of the trial, and the After Action Review by exercise evaluators as supplemented by video tape recordings.

DeGraf, William B., Erickson, David L., Hansen, Duncan N. and Stringfellow, Charles C. Report of Findings on National Training Center Functional Design and Development Schedules. Final Contract Report for the Defense Advanced Research Projects Agency (DARPA), Contract Number DAAK 40-78-C-0198, December 1978.

This report provides the results of an analysis of what could be done at the National Training Center if sufficient resources were committed. Time and cost estimates as well as estimated milestones are given. The document was

social to the Army for making estimates, and the contractor became the software developer for NTC-1A and the initial NTC set up.

Edwards, Richard I. National Training Center Developmental Plan. Unofficial Document published by TRADOC Systems Manager for the National Training Center, April 1979.

This report is an unofficial document that set forth concepts planned for training, evaluation, and instrumentation at the National Training Center. The approach outlined in the plan was approved by the Commanding General of the Training and Doctrine Command (TRADOC) on 19 March 1979.

Agnew, James B. "The National Training Center: The Next Thing to the Ultimate Realism," Army, Volume 30, Number 2, February 1980, pp. 30-36.

A 1980 report on the development, activities, and plans for the National Training Center (NTC). A brief history of the development of the NTC and a series of questions and answers are provided. The activities of a typical battalion task force are described, and the plans envisioned at that time are given.

Jlark, R. N., Charlet, J. D., Criswell, D. L. and Bird, S. M. National Training Center Instrumented Training Demonstration (NTC-1A). Final Contract Report for US Army Missile Command, Contract DAAK 40-79-C-0091, May 1980.

This is a contract report on the demonstration of instrumentation that could be employed to provide position location and firing event feedback to participants in Tactical Engagement Simulation exercises at the National Training Center (NTC). The study demonstrated that tactical units could be instrumented, and the data thus gained could be displayed for participants as a part of an After Action Review. (See also, Chaney and Cannon, 1981.)

Combat Developments Experimentation Command. NTC 1A - Stages IV and V Test Observation Report. Final Report TRADOC TRMS Number FC 096, May 1980.

This report was based on observations made and the data from a questionnaire distributed during the NTC 1A Demonstration. The indirect fire system employed was found to be lacking in the degree of realism desired. Valuable training through trial and error was provided. The questionnaire results showed a major effect on player career intentions with 20 percent of the players planning on leaving the service sooner than they had intended and 40 percent of the players planning to stay longer than they had previously intended.

Barber, Herbert F. and Solick, Robert E. MILES Training and Evaluation Test, USAREUR: Battalion Command Group Training. ARI Research Report 1290, June 1980.

This document is a report on the use of a battalion war game or battle simulation employed by itself or integrated with one company conducting a Tactical Engagement Simulation exercise using MILES (Multiple Integrated Laser Engagement System). The integrated portion of the research should be of interest to those who plan to integrate battle simulation at the National

Training Center (NTC) with force-on-force MILES exercises. Several problems were encountered during the integrated exercises that would apply to the communications and control of similar exercises at the NTC.

Dorsemma, Jim. "A National Training Center Blooming in the Desert," Soldiers, Volume 35, Number 7, July 1980, pp.18-22.

The article previews the plans for a National Training Center (NTC) at Fort Irwin in July 1981. Fort Irwin was selected because it was suitable for the deployment on the ground of a heavy task force. The terrain is open with miles of visibility. The plans call for eight to ten battalions to go through NTC during FY 81 and 42 armor and mechanized battalions by FY 84. An exercise entitled NTC-1A tested the laser-computer equipment planned for NTC (see Clark, 1980).

O'Neal, Russell D., Clark, Christine E., Erwin, Donald E., Freedman, Jerome, Langendorf, Richard M., Miller, James G., Peden, Irene C. and Sidwell, P. Phillip. Army Science Board (ASB) Ad Hoc Sub-Group Report on the National Training Center, March 1981.

This report views the National Training Center (NTC) as a significant improvement in Army training and makes several recommendations. Some of the recommendations include the following: poor indirect fire simulation needs to be improved, the Army and Air Force need to coordinate close air support at the NTC, and a system needs to be established to ensure that NTC data are collected and preserved. The report also suggests that After Action Review techniques could be improved and the battalion should be considered as a system for analysis.

Chaney, Mark and Cannon, Michael W. "Improving Combat Skills -- The National Training Center," Armor, Volume 90, Number 2, March-April 1981, pp. 37-41.

The authors were participants of the NTC-1A demonstration (Clark, Charlet, Criswell, and Bird, 1980) and provide their view of the instrumentation portion of NTC and their experiences. Instrumentation at the NTC is provided by the MILES linked to a main computer which has the capability to provide a video display of the ground with a color-coded trafficability map or contour map in different scales. Superimposed on the map are the player units or individual vehicles displayed in realtime. Every radio net is recorded for analysis. The tactical lessons learned included: the requirement to work as a combined arms team, the domination of the long range visibility battlefield by the TOW, and the requirement to make use of cover and concealment when maneuvering.

Tice, Jim. "Fort Irwin to Unveil New Equipment," Army Times, 17 August 1981, p.10.

This article was prepared shortly after the National Training Center (NTC) was reactivated as an active Army installation and documents the plans as of that time to have the capability of rotating 42 heavy battalions per year through Fort Irwin. The new equipment in the title included MILES (Multiple Integrated Laser Engagement System), telemetry for position/location, television cameras for videotape playback, and the reconnaissance vehicles modified to look like Warsaw Pact T-72 tanks, 122 mm assault guns and ZU-23-4 air defense weapons.

Keays, Ann. "National Training Center," Army Trainer, Volume 1, Number 2, Winter 1981-1982, pp. 5-9.

This is an article about the fully operational National Training Center (NTC) as of early 1982 describing the desert environment and the plans at that time for the capability of handling 42 battalions by 1984. There is a description and photos of the OPFOR VISMOS (Visual Modifications) of the M-551 light tank (Sheridan) to look like the Soviet ZSU-23/4, BRDM, and BMP. There is also a description of the NTC instrumentation system.

Mancus, Peter. "Top Gun: A Look at the Navy's Graduate Fighter Pilot School Leading to a Ph.D. in Combat Survival!" Airpower, Volume 12, Number 3, May 1982, pp.16-33.

An article describing the Navy training program that resulted in better combat performance and led directly to the Air Force program entitled Red Flag (Skinner, 1984) and, in turn led to the Army's development of the National Training Center (Gorman, 1976).

Tice, Jim. "Trainees at Fort Irwin Face Soviet Tactics," Army Times, 17 May 1982, pp. 15 & 38.

This article describes the opportunity that thousands of armor and mechanized infantry soldiers were receiving to attack and defend against a Warsaw Pact Threat force at the National Training Center (NTC). The force-on-force engagements using MILES and the instrumentation for display on digital maps are described as well as the recording of radio communications. The addition of MILES for Air Defense and Air-to-Ground engagement is projected for some time in FY '84.

Combined Arms Center. Combined Arms Training Tips, Volume 1, Number 1, August 1982.

This report, in newsletter format, was the first in a series based upon the performance of units at the National Training Center. Problems are identified in the seven operational systems with suggestions (tips) on how to avoid such pit falls. The seven operational systems are: maneuver, fire support, intelligence, air defense, mobility-counter mobility, combat service support, and command and control.

Fetig, James. "No Slack at the NTC," Army Trainer, Volume 1, Number 4, Summer 1982, pp. 24-27.

An article by an OPFOR officer stating that units are often overwhelmed at the NTC where the OPFOR "cuts no slack" for rotating units. Unit defensive position selection and selection of routes of withdrawal are often deficient. Listening posts are important in the desert even in daytime. MILES must be boresighted to be effective and small arms aimed to cause suppression.

Mennig, John J. "Combined Arms Training Notes," Army Trainer, Volume 2, Number 1, Fall 1982, pp. 30-33.

This article is the first in a series of "lessons learned" at the National Training Center (NTC) which focus on the seven operating systems: command and control, maneuver, fire support, intelligence, air defense, mobility-counter mobility, and combat service support. The focus of the first article is on command and control including the command group, tactical operations center (TOC) operations, the S1/S4 operations center, and the process of troop leading steps at the battalion/task force level.

Fetig, James. "NTC Desert Tips," Army Trainer, Volume 2, Number 2, Winter 1982, pp. 18-20.

This article provides suggestions for operating in the desert including suggestions for personnel and equipment. Desert camouflage hints are provided, and methods of desert navigation are suggested.

Weaver, W. Bruce and Griesemer, H. Alan. The Battalion Combat Outcome Model (BCOM): A Simulation of Unit Tactical Performance on Desert Terrain. Final Contract Report for ARI. Contract Number MDA 903-82-C-0656, January 1983.

This document reports on the development of an analytical tool for the National Training Center (NTC). The tool is a simulation of ground combat with current weapons systems on the desert terrain of Fort Irwin, California, the location of the NTC. The simulation is time stepped, stochastic, based on empirical results from a CDEC test employing Tactical Engagement Simulation (Combat Developments Experimentation Center, 1977). The simulation is implemented in standard FORTRAN 77, and a detailed description is provided in the report.

Mennig, John J. "Combined Arms Training Notes," Army Trainer, Volume 2, Number 2, Winter 1982, pp. 30-33.

This is the second article in a series of lessons learned at the NTC with emphasis on intelligence including terrain analysis, order of battle, and essential elements of information. The assets available to obtain combat information are also reviewed including the scouts, ground surveillance radars, observation and listing posts, patrols, and electronic warfare.

Tice, Jim. "Units Found Lacking 'Go-to-War' Skills," Army Times, 7 March 1983, p. 7.

This article is a review of a FORSCOM report entitled "NTC Training Observations" based on the first ten rotations at the National Training Center (NTC). The article emphasizes weaknesses in tank and antitank gunnery on the live fire exercises, and weaknesses in the employment of tanks to lead when in the attack and infantry to dismount when required during force-on-force exercises. Preparation for the NTC should include battle simulations for leaders, crew/squad qualification on tank/antitank weapons within six months, external combined arms ARTEPS at all echelons, company team live fire exercises (including mortars, artillery, and attack helicopters), and intensive training on the installation, operation, troubleshooting and maintenance of the MILES equipment.

Binder, L. James. "The War is Never Over At Fort in the Mojave," Army, Volume 33, Number 4, April 1983, pp. 30-35.

A photo-journalistic view of the National Training Center is provided. The OPFOR motorized rifle regiment is composed of a US Army mechanized battalion and tank battalion equipped with Soviet look-alike vehicles. Visiting battalions oppose the OPFOR using MILES, and the action is captured by television and other sensing devices for display at a control center. The NTC plans on having 22 battalions receive the training in 1983. The NTC is located at Fort Irwin, California near Death Valley in an area about as large as the state of Rhode Island.

Mennig, John J. "Combined Arms Training Notes," Army Trainer, Volume 2, Number 3, Spring 1983, pp. 34-37.

This is an article in a series of lessons learned at the NTC with emphasis on maneuver including movement techniques, selection of fighting positions, use of fighting positions, fire control and fire discipline, and security.

Thompson, Robert H. "Lessons Learned from ARMVAL," Marine Corps Gazette, Volume 67, Number 7, July 1983, pp. 36-44.

This article is about an Army and Marine Corps joint test and evaluation called the Advanced Antiarmor Vehicle Evaluation (ARMVAL). Over 150 battles were conducted employing a form of Tactical Engagement Simulation as a part of the evaluation of lightweight armored vehicles. For the first two months of force-on-force exercises the Threat Force dominated the Marine Force, "much as the OPFOR dominates the friendly task forces at the National Training Center." The problems the Marines encountered were poor execution of basics and the details of combined arms coordination. The author concludes that, although units attempt to prepare for these experiences, they do not get enough mission practice on destruction of an armored/mechanized force and with a system of accurate casualty assessment.

Mennig, John J. "Combined Arms Training Notes," Army Trainer, Volume 2, Number 4, Summer 1983, pp. 30-32.

This is an article in a series of lessons learned at the NTC with emphasis on mobility-counter-mobility-survivability including proper reconnaissance of obstacles for placement of engineers and equipment, organization to breach obstacles, breaching techniques, terrain analysis, obstacle plans, and properly constructed fighting positions.

Ellis, Julius. "Laser War in the Mojave," Science Digest, Volume 91, Number 8, August 1983, pp. 44-53.

This is a photo-journalistic article about the National Training Center (NTC). It includes a description of the Multiple Integrated Laser Engagement System (MILES), the NTC computer system, the opposing force (OPFOR), the OPFOR vehicles that have been modified to look like Soviet vehicles, and the problems of units that run their first exercises against the OPFOR. Comments about the potential analyses that could be made by using existing data tapes concludes the article.

Ozolek, David J. "Infantry in Desert Armor Operations," Armor, Volume 92, Number 5, September-October 1983, pp. 26-29.

This is an article by the Operations Officer of the Mechanized Infantry Battalion at the National Training Center advocating the use of dismounted infantry to secure the advantages of mobility in the desert for the tank and antitank elements of a battalion task force. In the offense the author suggests that dismounted infantry should conduct reconnaissance, obstacle reduction, and preattack raids on enemy strong points along the route of advance. For defensive operations the use of the dismounted infantry for patrolling gaps, defending obstacles, and performing security is advocated.

Combined Arms Center. Combined Arms Training Tips, Volume 2, Number 1, October 1983.

This report is a short list of Lessons Learned and suggestions for the integration of combat support elements into the battalion task force combat operations.

McFann, Howard H. and Avant, T. Roy. Candidate Applications Analyses for the ARI/NTC Data Base. Research Note 83-42, November 1983.

This report is a review of the potential uses of the data base available at the National Training Center (NTC). One use of the data is to provide descriptive information on adherence to doctrine. Another possible use of the data base is to make comparative analyses of battalions undertaking the same missions and to isolate factors which differentiate between high and low performance. Another form of analysis available would be to establish NTC performance as the criterion for antecedent conditions that could account for the performance. The authors suggest that, before the NTC data base will be useful, the status of the following potential problems must be known: the fidelity of the simulation, the extent and nature of the simulation, the amount of erroneous or lost data, the extent of pre-editing of the data, and the actual battlefield situation.

Humphrey, Vernon W., Jr. "Getting Ready for NTC: Desert Navigation," Army Trainer, Volume 3, Number 1, Fall 1983, pp. 32-34.

This article describes some of the difficulties of navigation at the National Training Center, Fort Irwin, California, and provides suggestions for better navigation, including: identify and keeping track of landmarks, keeping track of distance with the vehicle odometer, exercising precautions when using the compass in a vehicle, and remembering the magnetic declination.

Mennig, John J. "Combined Arms Training Notes," Army Trainer, Volume 3, Number 1, Fall 1983, pp. 28-31.

This is an article in a series of Lessons Learned at the NTC with emphasis on fire support coordination including knowing where the supported units are located, who is in support, how to get contact with the supporting element, and knowing the maneuver plan.

Humphrey, Vernon W., Jr. "Winning at the NTC: The Fight in the Gullies," Infantry, Volume 73, Number 6, November-December 1983, pp. 31-33.

The first in a series of articles where battles actually fought at the National Training Center with MILES will be analyzed along with the factors that proved to be decisive. In this example of a movement to contact mission, the battalion had too many units forward, put units out of supporting distance of each other, and allowed the OPFOR to destroy company teams piecemeal. The Lessons Learned included the following: no plan survives initial contact, units out of range are out of support, mutual support can be best accomplished by the commander, and tanks lead in tank country.

Combined Arms Center. Combined Arms Training Tips, Volume 2, Number 2, December 1983.

A list of suggestions on how to counter ground reconnaissance at the National Training Center.

Mennig, John J. "Combined Arms Training Notes," Army Trainer, Volume 3, Number 2, Winter 1983, pp. 30-33.

This article provides a series of recommendations on the employment of the scout platoon of a battalion task force based upon observations at the National Training Center (NTC). Guidelines are given for reporting, maintaining contact, employment of overwatch, coordination of fire support, and observation techniques. The planning and execution of reconnaissance and security missions are reviewed, and scout platoon training recommendations are given for home station training before coming to the NTC.

Skinner, Michael. Red Flag. Presidio Press, Novato, California, 1984.

This book is a photo-journalistic description of the Air Force Red Flag training operation at Nellis Air Force Base, Nevada. The operation was set up in 1975 as a result of the Air Force's poor showing in Southeast Asia. The training provides pilots with as much realism as is possible in peace time. The Air Force Red Flag operation was the inspiration for the Army's National Training Center (see Gorman, 1976).

Fobes, James L. The Army Research Institute Unit Performance Research and Development Center. ARI Research Note 85-97, June 1985.

This document describes the activities to develop a unit performance research and development center for the analysis of data from the National Training Center (NTC). The center would have two NTC data analysis stations capable of playing back data from NTC data tapes. (See also Fobes, 1984.)

Humphrey, Vernon W., Jr. "Winning at the NTC: Reconnaissance," Infantry, Volume 74, Number 1, January-February 1984, pp. 35-37.

This article provides a detailed description of the Opposing Force (OPFOR) use of reconnaissance units at the National Training Center (NTC). Dismounted and motorcycle patrols reconnoiter the Blue Force obstacles, Blue Force dispositions, and routes to positions in the rear of the Blue Forces. The author then makes recommendations for units going to the NTC, such as, intelligence staff officers should concentrate on finding the OPFOR,

reconnaissance efforts should be coordinated into a single plan, and the units must have a plan for countering the OPFOR reconnaissance units.

Brown, Michael. "Learning the Hard Way," Soldiers, Volume 39, Number 2, February 1984a, pp. 14-19.

This article is a description of a National Training Center (NTC) rotation that two battalions from the 1st Infantry Division at Fort Riley, Kansas took part in during August of 1983. The article includes information about administrative and logistic play at the NTC, and the problems of deploying to Fort Irwin, to include rail loading tracked vehicles. The article concludes with a brief description of the force-on-force exercises and the live fire exercises conducted at the NTC.

Brown, Michael. "Live from NTC - It's the War," Soldiers, Volume 39, Number 2, February 1984b, pp. 26-28.

This article is a companion article to the previous article and deals with the Training Analysis and Feedback Division at the National Training Center (NTC). The position location system using "B units" on tactical vehicles to send information through "A units" in the field to the computer displays is described. The employment of mobile video units for displaying the action in the field to the analysts and for video taping is also presented.

Brown, Michael. "The Eyes of the Battle," Soldiers, Volume 39, Number 2, February 1984c, pp. 24-25.

This article is another companion article for the two previous articles and deals with the Observer/Controllers (OCs) at the National Training Center (NTC). The OCs are members of the NTC staff that observe the units in the field and give them a review when an exercise is over. They also support the units during live fire and have the authority to control the unit as necessary to prevent accidents. The article includes the interview comments of one of the tank platoon OCs at the NTC.

Dunipace, Norma E., Henderson, Lewis, Smart, Kenneth G. Final Report for the NTC Take Home Package. Final Contract Report for ARI. Contract Number MDA 903-82-C-0656, February 1984.

This report recounts a research effort to develop a methodology to use the National Training Center (NTC) Take Home Packages (THPs) to identify recurring training issues that could be used to improve feedback or guide analysis of data bases established for the NTC. Eight THPs were analyzed using operating systems to identify broad training issues. A computer was employed to sort and analyze the data base. The review indicated that recurring training issues could not be readily identified. Learning seemed to occur from the first to the last defensive mission, but learning was not apparent from the first to last offensive mission.

Weaver, W. Bruce and Griesmer, H. Alan. NTC Training Performance Analysis Tool (TPAT). Final Contract Report for ARI. Contract Number MDA 903-82-C-0656, February 1984.

This report describes a tool developed for analyzing training performance at the National Training Center (NTC). The tool is a time-stepped, stochastic computer simulation that duplicates outcome variables measured at NTC. The simulation was developed based upon Tactical Engagement Simulation outcomes that occurred during a Combat Developments Experimentation Command test (1974). The simulation can be modified to conform with the actual outcome variables at NTC as they become available. The simulation is configured to run on digitized data of the training area at NTC. It could also be run on any terrain. The program was implemented in standard FORTRAN 77 to run on a VAX 11/780 computer.

Combined Arms Center. Combined Arms Training Tips, Volume 2, Number 3, March 1984.

This document is series of recommendations on improving the fire support plan within a battalion task force based upon observations at the National Training Center (NTC). The components of the fire plan are provided along with the methods of developing the fire plan after receiving the operations order. The document concludes with a list of specific problems, such as, the use of mortars, number of missions called after contact, adjusting supporting fires on an advancing enemy, coordinating close air support (CAS), the use of scatterable mines, and massing fires. Suggestions are given for each of these problems.

Hayslett, Jerrienne. "The Russians are Here," The Times Magazine, 5 March 1984, pp. 36-39.

A photo-journalistic article about the National Training Center (NTC) including a short history of Fort Irwin, California, the opposing force (OPFOR) that appear as Soviets, and the modifications to the OPFOR vehicles to look like Soviet equipment. The OPFOR reputation of losing only a few battles is presented. To be successful, the OPFOR capitalizes on every error the Blue Forces make. The article concludes with comments about the troops stationed at the NTC and their situation.

Fobes, James L. National Training Center Data Handbook. ARI Research Product 84-17, July 1984.

An overview of NTC data collection procedures is provided in this report as well as a description of the various types of digitized information, audio and video recordings available from force-on-force and live fire exercises. Data are reviewed as to their content, calculation, and display and include those data on battlefield status and events, tactical performance, communications, and subjective evaluations.

The pamphlets, articles, and other documents presented chronologically in this chapter all provide some guidance or suggestions for conducting Tactical Engagement Simulation training.

US Army Infantry School. Squad Combat Operations Exercise (Simulation)-- (SCOPES). Training Circular 7-2, Fort Benning, Georgia, 1973.

This was the first official document for use in the field on how to conduct a Tactical Engagement Simulation exercise. It was taken from the research efforts that resulted in two other documents (Hayes, Griffin, and Mathers, 1974 and Mathers, Shriver, Root, Word, Whitter, and Griffin, 1973) which never became official reports. The document provides general information about the system and details on how to prepare and conduct training, the casualty assessment system, and controllers. Appendices include scope training, a squad situation for training, an indirect fire system, identification numbers, and a program of instruction.

US Army Combat Arms Training Board. TANKS (Tactical Application of a Numerical Kill System), Fort Benning, Georgia, June 1974.

This document describes a casualty assessment system developed by the 1st Brigade of the 1st Cavalry Division as a means of providing for tank units the same benefits the infantry received from SCOPES (US Army Infantry School, 1973). The system was developed about the same time as REALTRAIN (US Army Armor School, 1975) and used crew self reports and a probability table to determine hits. The system had the advantage of requiring fewer controllers for larger exercises, but the disadvantage of no check on crew duties for these exercises. The official system adopted became REALTRAIN.

US Army Armor School. Tactical Training for Combined Arms Elements-- REALTRAIN. Training Circular 71-5, Fort Knox, Kentucky, January 1975.

This document is a guidebook on how to conduct training using the Tactical Engagement Simulation technique known as REALTRAIN. The general training system is described followed by the casualty assessment system employing controllers and a control radio net. The required training devices for achieving signature of the firing weapons, checking sight alignment, and identifying targets is shown. Direction is provided for preparing and conducting a REALTRAIN exercise in the field. The role of the controller is presented, and appendices are provided with detailed information.

Wilkins, G.H. "SCOPES Training," Infantry, Volume 65, Number 3, May-June 1975, pp. 50-52.

This article endorses SCOPES as the most realistic form of force-on-force training at that time. The article provides several suggestions on methods for conducting platoon exercises based on the author's experience running almost 40 such exercises. Advice is offered on site selection, defense

preparation, training ammunition, indirect fire play, and operations orders. The suggestions made on controller training are very sound and practical. The author found that attacking platoons often succeeded in penetrating and rolling up the defense. Some of the author's suggestions are in direct contradiction to the SCOPES Training Circular which was based upon more experience in field tryouts and has official endorsement.

Bosley, John J., Blanton, Robert, Onoszko, Peter W. J., Knerr, Claramae S. and Root, Robert T. Tactical Engagement Simulation Training Techniques: Two Training Programs for the Conduct of After Action Reviews. ARI Research Product 79-2, January 1979b.

This document is a how-to guide for conducting After Action Reviews (AARs) with REALTRAIN. The AAR differs from the military critique that is most familiar to soldiers. It is a guided discussion designed to improve future performance rather than a castigation for past mistakes. The training programs provided are a self-study guide and a unit training program guide. (See also Scott, 1983 for a guidebook on AARs making use of MILES).

TRADOC System Manager for Tactical Engagement Simulation. Training Circular 71-4. How to Plan, Prepare, and Conduct MILES Training. Coordinating Draft, September 1980.

This document was the first draft of what became Training Circular 25-6 (Department of the Army, 1982). However, it is currently still in use in some units (Downing, Riley, and Rodriguez, 1984, p. 22) and provides more detail than the later document. For example, the section on evaluation which included a sample feedback report and the developmental Training and Evaluation Outlines (T&EOs) were removed. The T&EOs were particularly controversial because they included as standards: mission accomplishment with fewer than 30 percent casualties in offensive missions and 50 percent casualties for defensive missions.

Hannaman, David L., Freeble, Jerome D., Jr. and Sulzen, Robert H. "One-on-One Tactical Training," Infantry, Volume 72, Number 3, May-June 1982, pp. 30-34.

This is an article describing a training technique employing Tactical Engagement Simulation for individual soldiers opposing each other with rifles equipped with MILES and hand grenades. Individual techniques/tricks that seemed to work are described for the employment of the rifle and the grenade in both attack and defense situations. The article concludes with individual soldier motivation that resulted and the unexpected benefits that were gained.

Wolf, Don H. "Dragon Gunners Score with MILES," Army Trainer, Volume 1, Number 4, Summer 1982, pp. 38-40.

This article describes in detail the MILES Dragon with related equipment and the how the system was used by a unit instead of the launch effect trainer (LET) for quarterly qualification of Dragon gunners. Advantages and disadvantages for using MILES for this training are presented.

Department of the Army, Training Circular 25-6, Tactical Engagement Simulation Training with MILES, Washington, DC, September 1982.

An earlier version of this circular was entitled, "How to Prepare and Conduct MILES Training." The circular gives the description of the proper method to conduct Tactical Engagement Simulation; tells how to plan and prepare for MILES training; and, provides a series of appendices with detailed descriptions of specific procedures and requirements.

Department of the Army, Graphic Training Aid 25-6-1. MILES Instructor's Lesson Plan Booklet. Washington, DC, November 1982.

This document is a series of lesson plans developed by the Office of the TRADOC Systems Manager for Tactical Engagement Simulation based on the experiences of the third Operational Test of MILES and used by the new equipment training team (NETT) while training controllers worldwide. These lesson plans were used to conduct training for both the use of the MILES equipment and the methods of training Tactical Engagement Simulation.

Department of the Army, Graphic Training Aid 25-6-2. MILES Infantry Field Controller's Guide. Washington, DC, November 1982.

This GTA is a pocket sized guidebook for infantry controllers which includes controller equipment, rules of engagement, controller responsibilities, inspection procedures, and the operating procedures for infantry MILES equipment.

Department of the Army, Graphic Training Aid 25-6-3. MILES Armor Field Controller's Guide. Washington, DC, November 1982.

This pocket sized booklet is a guidebook for tank controllers which includes controller equipment, the electronics system test set, operating and troubleshooting procedures for the armor MILES equipment, the rules of engagement, and a controller responsibility checklist.

Robertson, J.A. How to Plan, Prepare, and Conduct MILES Training Using the Squad Leader's Combat Laser Course. Soldiers Needs Division, High Technology Test Bed, Fort Lewis, Washington, 1982.

This document is a general guide on how to conduct a MILES squad leader training course using the squad leader's squad and conducting repetitions of the course. The guide includes a Fragmentary Order (FRAGO), a general lay out, and a list of relevant soldier's manual tasks. (See also Stout, 1982.)

Rogers, Glenn F., Jr. and Hackney, Michael S. "MILES Sniper Training," Infantry, Volume 73, Number 2, March-April 1983, pp. 20-23.

This article describes the development of a sniper training program making use of the Multiple Integrated Laser Engagement System (MILES). The authors review problems encountered and solutions developed for the following: weapon zeroing, terrain selection, and scenario development. The scenario developed included two sniper teams and a 14-man patrol in a free play exercise with training benefits for both groups. A case is made for repeated exercises. MILES is endorsed as a training device. (See also Department of the Army, Headquarters, 2d Brigade, 3d Armored Division, 1982.)

Dick, Scott A. "Mechanized MILES," Army Trainer, Volume 2, Number 3, Spring 1983, pp. 53-55.

This is an article intended to assist those conducting MILES training for mechanized units. An equipment checklist is provided as a decision guide. A step-by-step procedure is presented to consider the level of training of the unit, the personnel requirements, the training to be accomplished, scenario development, and a time schedule. The article concludes with a list of common problems in the use of MILES.

Scott, Thomas D. Tactical Engagement Simulation After Action Review Guidebook, ARI Research Product 83-18, September 1983.

This document is a guide for conducting an After Action Review (AAR) following a Tactical Engagement Simulation exercise. Procedures for preparing and conducting AARs are given separately for the squad/platoon level and the company level. The techniques of an AAR are discussed and contrasted with those of the traditional critique. Methods are presented for conducting the AAR and providing training diagnosis. (See also Bosley, Blanton, Onoszko, Knerr and Root, 1979b.)

Clark, Robert L. "MILES Gladiator Training," Army Trainer, Volume 3, Number 1, Fall 1983, pp. 50-52.

This article is a description of how MILES training is conducted at Fort Stewart, Georgia. Some guidelines are provided on techniques found to be successful for the application of MILES in a mechanized division.

Downing, Wayne A., Rielly, James R. and Rodriguez, David M. "Training for Maneuver Warfare," Military Review, Volume 64, Number 1, January 1984, pp. 16-27.

This article reviews a brigade's use of Tactical Engagement Simulation in West Germany to conduct battalion level training with MILES. The authors point out that, while standard means of exercise control may be of benefit to commanders, realism is lacking at platoon, squad or crew, and individual soldier level. They suggest that MILES should be used even at brigade and battalion level with an investment in a modest amount of additional resources. They also suggest that platoon and company level ARTEPs should precede higher level exercises, and a MILES review should be conducted before the exercises begin. They insisted that controllers not use control guns as punishment for tactically unsound actions, but let the hitting ability of the opposing force settle the issue. Indirect fire markers were used for realistic artillery damage assessment. To issue, install and turn-in MILES equipment the brigade set up MILES operations centers that operated 24 hours a day and provided direct exchange support. The authors concluded that the realism for soldiers and commanders was worth the effort.

Department of the Army, Graphic Training Aid (GTA) 25-6-7. MILES Instructor's Controller Training Guide. Washington, DC, February 1984.

This document provides an introduction and a complete four-hour lesson plan for the training of MILES controllers. The lesson plan includes a lesson plan

outline, over 40 View Graphs, and a lesson manuscript keyed to the View Graphs. This GTA is intended to be a part of a set to include GTA 25-6-1B and GTA 25-6-1C.

Department of the Army, Graphic Training Aid (GTA) 25-6-9. Instructor's MILES Infantry Systems Training Guide. Washington, DC, February 1984.

A document based upon GTA 25-6-2 and intended as an improvement. The guide provides more detail than GTA 25-6-2 and more illustrations. When approved and printed, it should be of more assistance to implementation of Tactical Engagement Simulation in units.

Department of the Army, Graphic Training Aid (GTA) 25-6-8. Instructor's MILES Tank System Training Guide. Washington, DC, February 1984.

A document based upon GTA 25-6-3 and, like GTA 25-6-1B, intended as an improvement. The guide provides more details and illustrations and should be of more assistance to the implementation of Tactical Engagement Simulation in units.

LEADER TRAINING WITH TACTICAL ENGAGEMENT SIMULATION
AS THE MEASURE OF PERFORMANCE

In the early days of Tactical Engagement Simulation, a research project was begun which attempted to abstract the field environment to board games and reduced field exercises. Unlike other leader training, this research attempted to estimate gains in learning by measuring unit performance during Tactical Engagement Simulation exercises. The project had the title EFFTRAIN during its early development which meant effective and efficient training for leaders.

EFFTRAIN Research Evaluation Conducted at Fort Lewis, Washington. Contract Report for ARI. Contract Number DAHC 19-74-C-0024, October 1974.

This report was the first of a series (Root, Hayes, Word, Shriver, and Griffin, 1979 and Shriver, Jones, Hannaman, Griffin, and Sulzen, 1979) for efficient and effective training of leaders (EFFTRAIN) to perform in Tactical Engagement Simulation exercises following the leader training. Five officers each received either EFFTRAIN training or individual study of a field book prior to attack and defense exercises. The EFFTRAIN training appeared to have some benefit for training leaders in defense techniques (the EFFTRAIN officers won all their battles), while its effectiveness for offense techniques was less than ideal (the EFFTRAIN officers won three of five battles). This report was the first of the Tactical Engagement Simulation research reports to make use of the narrative and map as a means of providing details of battles for analysis of the phenomena.

Shriver, Edgar L., Griffin, Glenn R., Hannaman, David L., Jones, Donald R., and Eden, Mark. Development of Training Test Situations for Small Units: Field Tryout of the EFFTRAIN Training Model in the Berlin Brigade, 1975. Contract Report for ARI. Contract Number DAHC 19-75-C-0030, August 1975.

This report is summarized in an official report (Root, Hayes, Word, Shriver, and Griffin, 1979) on the effects of leader training as measured by Tactical Engagement Simulation exercise outcomes. The full report itself was somewhat lengthy and rambling. However, it has more detail on the conduct of the research and the outcomes (especially in leader war game play), and it has appended a wealth of information on concepts and techniques developed during the research. For example, the appendices include a discussion of issues in simulation fidelity and levels of abstraction, the effects of a better player, controller learning, and a list of tactics developed through game play. In point of fact, the tactics developed may have been the real independent variable in this and similar studies of unit performance in Tactical Engagement Simulation exercises following leader training.

Shriver, Edgar L., Griffin, Glenn R., Hannaman, David L. and Jones, Donald R. Small Combat Arms Unit Leader Training Techniques: Rules of Play for Two Player/Multiplayer Infantry Mapboard Games. ARI Research Product 79-4, January 1979a.

This document is a guidebook for conducting a manual board war game for light infantry units with either one or two players on each side. The game was developed for and used in the EFFTRAIN Project (Root, Hayes, Word, Shriver, and Griffin, 1979 and Shriver, Jones, Hannaman, Griffin, and Sulzen, 1979) which employed a criterion measure of unit performance in the field. (See also Shriver, Griffin, Hannaman, and Jones, January 1979b.)

Shriver, Edgar L., Griffin, Glenn R., Hannaman, David L. and Jones, Donald R. Small Combat Arms Unit Leader Training Techniques: Rules of Play for Infantry Field Opposition Exercise. ARI Research Product 79-5, January 1979b.

This document is a guidebook for conducting a specially developed Tactical Exercise Without Troops (TEWT) that included Tactical Engagement Simulation (TES) and was called a FOX (Field Opposition Exercise). The exercise was initially developed for rifle platoon leaders to help bridge a gap in performance noticed between squad and platoon level field exercises that had not been adequately filled by a board game (Shriver, Jones, Hannaman, Griffin, and Sulzen, 1979). The FOX employed different levels of TES fidelity. At lower levels of fidelity controllers estimated casualties similar to board game procedures, while at higher levels the full TES fidelity was used.

Shriver, Edgar L., Griffin, Glenn R., Hannaman, David L. and Jones, Donald R. Small Combat Arms Unit Leader Training Techniques: Rules of Play for Combined Arms Mapboard Game. ARI Research Product 79-6, January 1979c.

This document is a guidebook for conducting a board war game for combined arms units. It was developed at the same time as the infantry game (Shriver, Griffin, Hannaman, and Jones, 1979a), but not employed in the research. Later the game was modified by Medlin and used in his Tactical Engagement Simulation forecasting research (1979a and 1979b).

Root, Robert T., Hayes, John F., Word, Larry E., Shriver, Edgar L. and Griffin, Glenn R. Field Test of Techniques for Tactical Training of Junior Leaders in Infantry Units (Project EFFTRAIN). ARI Technical Report 79-A21, July 1979.

This report presents research comparing the use of a leader training technique (EFFTRAIN) with, at that time, current practices in unit training. The training technique included a board war game, a field opposition exercise for leaders, and SCOPES exercises for units. In comparison battles, the EFFTRAIN trained units won five of six battles at increasingly unfavorable force ratio odds. The experimental group evidently made better use of defensive depth, offensive dispersion, and the effects of indirect fire. (See also Shriver, Jones, Hannaman, Griffin, and Sulzen, 1979.)

Shriver, Edgar L., Jones, Donald R., Jr., Hannaman, David L., Griffin, Glenn R. and Sulzen, Robert H. Development of Combat Arms Small Unit Leader Tactical Training Techniques and a Model Training System. ARI Research Report 1219, July 1979.

This report documents the development of leader training techniques that included an infantry mapboard game (Shriver, Griffin, Hannaman, Jones, 1979a), the infantry field opposition exercise (Shriver, et al, 1979b), and the

combined arms mapboard game (Shriver, et al, 1979c). Another leader training technique that was conceived but never tried out was a field opposition exercise for combined arms leaders. The developmental trials for each of the other techniques is reviewed including unit performance in Tactical Engagement Simulation exercises following training and personnel attitudes toward training.

Stein, Earl S., Sulzen, Robert H. and Jones, Donald R., Jr. The Training Effects of Board Game Combat Simulation on Tactical Unit Field Performance. Paper presented at the meeting of the North American Simulation and Gaming Association, San Antonio, Texas, October 1979.

This is the first report on a study conducted with 15 rifle platoons and the leader training received as measured by Tactical Engagement Simulation field exercises. Descriptive data suggest that the leader training (board game play) had some effect on subsequent field exercise performance, however, not as much as anticipated. A competing variable not adequately controlled was the proficiency of the opposing force which changed little over the course of the trials while the platoons changed daily. (See also Sulzen, Stein, and Jones, 1980.)

Henriksen, Kermit F., Jones, Donald R., Jr., Hannaman, David L., Wylie, Peter B., Shriver, Edgar L., Hamill, Bruce W. and Sulzen, Robert H. Identification of Combat Unit Leader Skills and Leader-Group Interaction Processes. ARI Technical Report 440, January 1980.

The research presented in this report was a review of leader research literature and an analysis of Tactical Engagement Simulation data from previous field exercises. The result was the development of a leader skill taxonomy having the following five major categories: management, communication, problem solving, tactical skills and technical skills.

Sulzen, Robert H., Stein, Earl S. and Jones, Donald R., Jr. The Effects of Two Leader Tactical Training Techniques on Rifle Platoon Performance. Working Paper SS/TA-80-2, August 1980.

This document is a research report of leader training effects on the field performance of rifle platoons in Tactical Engagement Simulation exercises. A control group receiving no special leader training was compared with two groups receiving different kinds of leader training with board games: one in which the leaders were given the opportunity to discover principles, and one in which the leaders were guided to follow principles. The two days of leader training prior to field exercises did not significantly affect casualties inflicted or suffered during those exercises. The leaders receiving guided training appeared to be more cautious, took longer to complete field exercises, and employed more indirect fire rounds. All game trained leaders produced more casualties with indirect fire than the control group. The game trained leaders were more likely to have their squads separated laterally and in depth than the control leaders. (See also Stein, Sulzen, and Jones, 1979, an earlier report of the same research.)

SUPPORT WEAPONS IN TACTICAL ENGAGEMENT SIMULATION

Most of the early work in Tactical Engagement Simulation concentrated on the Infantry and Armor branches for direct fire simulation. Artillery play was also included, but primarily for the Forward Observer (FO) or FIST (Fire Support Team). This chapter deals with special programs that developed Tactical Engagement Simulation for Armored Cavalry units, Artillery units, and Air Defense units. One article (Word, Loftis, and McQuitty, 1978) emphasizes the Artillery FO/FIST in combined arms exercises.

Word, Larry E., Loftis, Donald D., and McQuitty, John T. "Enhancing Combined Arms Training," Field Artillery Journal, Volume 46, Number 4, July-August 1978, pp. 51-53.

This article presents evidence for the advantages of including indirect fire play during Tactical Engagement Simulation exercises based on the Armor/Antiarmor REALTRAIN Validation test (Scott, Meliza, Hardy, Banks, and Word, 1979). The FO was often forgotten during early exercises and caused casualties to his own force. As more exercises were conducted, the indirect fire was employed better and caused more casualties to the enemy. The FOs also learned better how to support combined arms forces to include the selection of his position, employment of smoke, and preparation of detailed and practical fire support plans.

Knerr, Claramae S., Hamill, Bruce W. and Severino, Angelo, A. Engagement Simulation for Armored Cavalry: Initial Test. ARI Research Problem Review 78-5, August 1978.

This document presents the details on the development of Tactical Engagement Simulation for armored cavalry units. Procedures were developed which emphasized the reconnaissance function during REALTRAIN compatible exercises and which incorporated these functions into the controller debrief and After Action Review.

Bosley, John J., Blanton, Robert, Onoszko, Peter W. J., Knerr, Claramae S. and Root, Robert T. Tactical Engagement Simulation Training Techniques: REALTRAIN for Armored Cavalry. ARI Research Product 79-1, January 1979a.

This research product is a guide for armored cavalry units on how to conduct Tactical Engagement Simulation with REALTRAIN techniques. The research was developmental in nature, and resulted in specific techniques that differ from those used for other combined arms units. Since armored cavalry units have a mission other than direct attrition, modifications were needed in the rules of engagement.

Sevilla, Exequiel R. Tactical Engagement Simulation Training Techniques: Indirect Fire Simulation Procedures. ARI Research Product 79-3, January 1979.

This document is written in the form of a draft training circular on how to conduct simulated indirect fire for different sized units participating in Tactical Engagement Simulation exercises. It provides the duties of the Fire Marker Control Center (FMCC) personnel and the fire markers. It also presents a detailed description of the procedures to be followed with indirect fire simulation for various types of tactical exercises. (See also King, Stein, Sevilla, and Seed, 1980 and Stein, King, Sevilla, and Seed, 1980.)

Erwin, Donald E. "Training Simulations for Air-Ground Combat," Army R,D & A, Volume 20, Number 4, July-August 1979, pp. 20-21.

This article is the description of Tactical Engagement Simulation developed for short range air defense weapons and attack helicopters employing techniques compatible with REALTRAIN. The article also includes the crew performance change after training with the system, and the views of leaders and controllers are presented on the use of the system for training.

Erwin, Donald E. and Stein, Earl S. "AGES: Realistic Tactical Training for Air Defenders," Air Defense Magazine, July-September 1979.

This is a descriptive article on the development of Air-Ground Engagement Simulation (AGES) which originally was a Tactical Engagement Simulation procedure compatible with REALTRAIN (see also, Erwin, 1979). The casualty assessment procedures are given, and the results of a test of the system in Europe are presented which include improved crew performance and favorable attitudes as expressed in the amount of AGES training recommended.

Stein, Earl S. and Erwin, Donald E. Air Ground Engagement Simulation (AGES): Realistic and Effective Training for Air Defense Personnel, Proceedings of the First Interservice/Industry Training Equipment Conference, Technical Report I-H-316, Naval Training Equipment Center, Orlando, Florida, November 1979.

This document describes the development of Tactical Engagement Simulation for Air Defense and Army Aviation and compatible with REALTRAIN. A tryout of the procedures in Europe found that the system had performance advantages for the Chaparral and Vulcan air defense systems while the results for the Redeye system were inconclusive. Attitudes of the troops favored the use of the AGES for training.

King, Francis, Stein, Earl S., Sevilla, Exequiel R., Jr. and Seed, Richard J., III. Artillery Engagement Simulation. ARI Reserach Report 1245, May 1980.

This is a report describing the development of a system for including the artillery Fire Direction Center (FDC) and guns in the play of Tactical Engagement Simulation (the Forward Observer [FO] was already included in the play, [see Department of the Army TC 25-6, 1982]). The system requires controllers at the guns and FDC plus a hand-held calculator in addition to the fire marker control system as now implemented. It allows for all artillery elements to receive training and feedback on the effectiveness of their performance. (See also Stein, King, Sevilla, and Seed, 1980.)

Stein, Earl S., King, Francis, Sevilla, Ezequiel and Seed, Richard J., III.
"MILES Realistic Training for Direct Support Artillery," Field Artillery Journal, Volume 48, Number 5, September-October 1980, pp. 145-47.

This article describes a system for including the fire direction center (FDC) and guns into MILES exercises where the procedures they follow will have an effect on where the fire markers place rounds on the ground. In a test described in the article, accuracy increased through 36 missions. The system makes use of soldiers trained as "gun controllers" to call the fire marker control center with data from the guns. These data are then "reverse calculated" and coordinates for the burst are sent to the fire markers. (See also King, Stein, Sevilla, and Seed, 1980.)

Terrill, William L. "ADA at the NTC," Air Defense Magazine, October-December 1982, pp. 8-11.

This article reviews the status of the National Training Center (NTC) with regard to Air Defense Artillery (ADA) as of mid-1982. Redeye, Vulcan, and Chaparral ADA units that go to the NTC as a part of the brigade "slice" should prepare themselves by completing an external ARTEP within the past six months, completing a qualification gunnery program, being proficient in the control and support of continuous operations, and by being proficient in both active and passive air defense and in nuclear, biological, chemical (NBC) defensive measures. The article also states that a MILES system for ADA units and Army helicopters was to be ready by late 1983.

Partheymeuller, Richard R. Concept Evaluation of Simulation of Area Weapon's Effects. TRADOC Combined Arms Test Activity (TCATA) Letter Report CEP-106, July 1983.

This document is a concept evaluation of the Simulation of Area Weapons Effects (SAWE) which used a pneumatic launcher for firing a Styrofoam indirect fire cue simulator (IFCS) that could be made MILES compatible. Soldier's subjective responses indicated that they liked the SAWE system but thought that the IFCS should produce a bigger bang, more smoke, and a larger flash. Comparing the current fire marker system with the SAWE shows little difference in training value. The SAWE would be the best system if the safety restrictions were removed and the suggested improvements were made.

TACTICAL ENGAGEMENT SIMULATION FOR UNIT PERFORMANCE MEASUREMENT
AND RESEARCH

Early in Tactical Engagement Simulation development it became apparent that the realistic casualty assessment inherent with the system could lead to far more reliable and objective measurement than had previously been possible. Researchers were also struck with the dynamic nature of the environment and the difficulties of performing task analysis, specifying training objectives, and providing diagnostic feedback. This chapter reviews several of the documents generated as a result of concepts developed and research conducted.

Combat Developments Experimentation Command. Tactical Effectiveness Testing of Antitank Missiles (TETAM), Volume VIII: Phase III. Final Report, CDEC Experiment 11.8, February 1974.

This volume is a report on the fully instrumented two-sided, Real Time Casualty Assessment (RTCA) experiment featuring tactical play. The report emphasizes the dynamic and competitive nature of the experiment contrasted with one-sided experiments. Observations are reported, such as the difficulty to detect and acquire targets from their firing signatures in camouflaged positions. One section deals with the different tactics employed during the experiment and the results.

Combat Developments Experimentation Command. Tactical Effectiveness Testing of Antitank Missiles (TETAM), Volume IX, Phase III, Data Package. Final Report on CDEC Experiment 11.8, February 1974.

This report is a supplement to the Volume VIII report and includes data useful for alternative analyses of the Tactical Effectiveness Testing of Antitank Missiles (TETAM) experiment. The data includes detection data, engagement summaries, and time line profiles.

Root, Robert T. and Word, Larry E. Development of a Test Bed for Evaluation of Small Unit Doctrinal Alternatives in the Combat Arms. Paper presented at the 1974 Army Science Conference, West Point, New York, June 1974.

This paper reviews the early development of Tactical Engagement Simulation with emphasis on the realistic job setting providing two-sided, free-play engagements. The paper also reviews the Unit Performance Assessment Model which made use of objective measures for a tactical unit's achievements in relationship to the unit's costs during mission execution. The paper concludes with a recommendation that small unit doctrinal alternatives could best be determined in a test bed situation that included a realistic simulated combat environment with objective measures for evaluation.

Cunningham, R. F., Muller, E. R. and Clovis, E. R. Planning a Combined Arms Unit Training Research and Evaluation Test Bed. Final Contract Report for ARI. Contract Number DAHC 19-73-C-0055, October 1974.

This document is a plan for the establishment of an Army unit training research and evaluation facility for the improvement of human performance during Tactical Engagement Simulation exercises by combined arms personnel. The facility would be used for tests of training methods, training devices, and training evaluation procedures. The plan included a three phase development cycle and guidelines for facilities development and management. The facility plan was never implemented as designed.

Cloviss, E. R. and Muller, T. H. Development of Procedures for Evaluating Unit Performance. Final Contract Report for ARI, two Volumes. Contract DAHC 19-73-C-0055, March 1975.

This report concerns the development of a methodology for evaluation of small combat units in a Tactical Engagement Simulation environment where costs (e.g., casualties suffered) and achievements (e.g., casualties inflicted) are traded-off. The first stage of the development was the creation of criterion lists and ratings given to the lists by military experts. Following this step, the Unit Performance Assessment Model (UPAM) was developed which made use of the criterion measures in a mathematical model which included standards set by the user. The cost and achievement criteria were sets of objective, quantitative data for evaluating unit performance of a rifle platoon attacking, a rifle squad defending, and of a tank platoon in a meeting engagement.

Shriver, Edgar L. Two Sided Engagement Training. Paper presented at the Conference on Application of Advanced Training Technology, Fort Gordon, Georgia, June 1975.

This paper is an anecdotal account of the early development of Tactical Engagement Simulation from early games in the woods (SCOPES) to the refinement of situations for tank employment (REALTRAIN). The researchers and the subjects during the initial trials were excited and motivated by the two-sided free-play competitive nature of the system. The development of what was to become the After Action Review grew out of a spontaneous gathering of participants at the end of trials to find out what had happened. The goals of the later validation research are outlined, and the power of the situational context of simulated combat for individual as well as collective training is suggested.

Rosen, Melvin H., Chiorini, John R., Hill, Howard G., and MacNaughton, Bryce T. Development of a Combat Unit Evaluation System (CUES), Two Volumes. Final Contract Report for ARI. Contract Number 19-75-C-0029, April 1976.

This report documents research conducted to develop candidate systems for evaluating combat units and to determine the preferred candidate based on an analysis of costs and benefits. The report concluded that, to be effective, the evaluation system must provide for the following: close correspondence of evaluation tasks to actual tasks and of evaluation environment to actual environment; validity of evaluation standards; expertise of evaluators; standardized procedures (for recording, aggregating, and interpreting data); ability to interpret results in light of test conditions; institution of feedback mechanisms to supply appropriate parties with accurate information; and, Tactical Engagement Simulation to obtain product measures of military performance.

Shriver, Edgar L. Task Analysis for Combat Arms. First International Learning Technology Congress & Exposition on Applied Learning Technology, Proceedings, Volume II, Society for Applied Learning Technology, Washington, DC, July 1976, pp. 8-11.

This document is a concept paper suggesting that the process of task analysis for combat situations differs from other forms of task analysis. Many forms of task analysis are machine dominant, but the tactical side of combat is characterized as a game of heuristics. The heuristics or principles a leader uses are also dependent upon his unit's ability to execute the principles. The heuristics that work in a simulated tactical environment may be tried out by several players to verify their utility and application. Heuristics are developed by induction, not by deduction as are the task analytical procedures in machine-dominant situations.

Combat Developments Experimentation Command. Evaluation of the Frontal Parapet Foxhole, Part 7 (PARFOX VII). Final Report CDEC Experiment FC033, October 1976.

The report on the parapet foxhole which was not as interesting as the lessons learned serendipitously from the 72 trials in a Tactical Engagement Simulation environment with an infantry platoon attacking an infantry squad.

Erwin, Donald E. Development and Use of Evaluative Criteria for Comparing Models of Unit Performance. Paper presented at the meeting of the Military Testing Association, Gulf Shores, Alabama, October 1976.

A description of the development and use of a methodology to evaluate eight techniques for assessing tactical unit performance. The eight techniques placed different emphasis on objective versus judgemental data and product versus process data for combinations of either evaluative and/or diagnostic feedback. The unit assessment technique selected was the situational dependent model (Sulzen, Root and Epstein, 1976).

Pulliam, Robert and Mathers, Boyd L. Simulation of Combat as a Measure of Individual Proficiency. Paper presented at the Meeting of the Military Testing Association, Gulf Shores, Alabama, October 1976.

This paper summarizes some of the results presented in the report by Hayes, Griffin, and Mathers (1974). It also presents a model for the use of simulation in measuring proficiency. A set of principles are suggested for using simulation in training or evaluation.

Root, Robert T., Epstein, Kenneth I., Steinheiser, Frederick H., Hayes, John F., Wood, Shelton E., Sulzen, Robert H., Burgess, George G., Mirabella, Angelo, Erwin, Donald E. and Johnson, Eugene, III. Initial Validation of REALTRAIN with Army Combat Units in Europe. ARI Research Report 1191, October 1976.

This research report is comprehensive but lengthy. Combined arms teams with differing experience/training were pitted against each other in Tactical Engagement Simulation exercises. As expected, the teams receiving more training/experience performed significantly better. The importance of force

evaluation techniques were developed as a part of the data collection effort. The report also contains questionnaire analysis and logistical considerations for realistic tactical field exercises.

Shriver, Edgar L. Ratio of Forces Techniques for Scoring Units in Combat Simulations, Paper presented at the Meeting of the Military Testing Association, Gulf Shores, Alabama, October 1976.

This document is a concept paper that briefly describes Tactical Engagement Simulation and the problems of measurement for tactical units. The paper then presents a proposed evaluation scheme with a three part scoring system. The three part scoring system includes an indication of the force ratio for the engagement, whether the engagement was won or lost, and the percentage of personnel lost during the engagement. The author discusses the problems of unit change of personnel, skill of opposing units and self ratings.

Sulzen, Robert H., Root, Robert T. and Epstein, Kenneth I. Development of an Evaluation Model and Training Program for the Multiple Integrated Laser Engagement System (MILES) Phase I. ARI Research Program Review 76-7. October 1976.

This document is a status report on the conceptual development of an evaluation model and training program for Tactical Engagement Simulation as of mid-1976. The evaluation model at this point was termed "situational dependent" and included objective data about forces employed, their location, and time. Judgemental observations were to be included in the model for a concept termed "coordination of available forces." The model was to be able to provide predicted performance for any chronological moment in time given the required data inputs. [The situational dependent model was probably the father of the Combat Operations Training Effectiveness Analysis Model (COTEAM) Medlin, 1979c and Johnson and Wheaton, 1981.] The conceptual training program developed at that time was much more complex than the training program actually conducted with MILES (Department of the Army GTA 25-6-1, 1982).

Combat Developments Experimentation Command. Evaluation of the Frontal Parapet Foxhole, Part 7 (PARFOX VII), Supplement 1, Data Package, Volume I. Report on CDEC Experiment FC033, November 1976.

This report is a supplement to the basic report which is useful for alternative analyses of the data. The specifics contained in this document include: tactical data summaries, map traces, event listings, and direct and indirect casualty assessment for each of the 72 trials conducted as a part of the PARFOX VII study. Independent variables identified with each trial are day/night, complete/missing defensive position, foxhole type, site, defensive squad and threat platoon.

Combat Developments Experimentation Command. Evaluation of the Frontal Parapet Foxhole, Part 7 (PARFOX VII), Supplement 1, Data Package, Volume II. Report on CDEC Experiment FC033, November 1976.

This report is a supplement to the basic report which contains the time lines for each of the 72 trials conducted as a part of the PARFOX VII study.

Combat Developments Experimentation Command. Evaluation of the Frontal Parapet Foxhole, Part 7 (PARFOX VII), Supplement 1, Data Package, Volume III. Report on CDEC Experiment FC033, November 1976.

This report is a supplement to the basic report which contains a site survey of each site used in the PARFOX VII study to include a graphic representation of the fields of fire from each foxhole used during the experiment. The document also includes the survey responses of the player/participants to the following: summary debriefing questionnaire, post-trial questionnaire and attitudinal measures.

Combat Developments Experimentation Command. CDEC Observations and Military Judgements. Evaluation of the Parapet Foxhole, Part 7 (PARFOX VII). Report on CDEC Experiment FC033, December 1976a.

A summary report based on the PARFOX VII Study (Combat Developments Experimentation Command, 1976b). In a vein similar to the Blalock and Mullis report (1976) of observations during the 3x5 test, this report provides serendipitous observations of tactical training benefits for dismounted rifle training in a Tactical Engagement Simulation environment. Observations included the need for a rapid succession of command when leaders become casualties and the advantages of training the RTO in the adjustment of indirect fire.

Root, Robert T. and Erwin, Donald E. Engagement Simulation: A Training Environment for the Learning of Complex Tactical Skills. Paper presented at the Military Operations Research Society 38th Symposium, Fort Eustis, Virginia, December 1976.

This document reports on Tactical Engagement Simulation for the training and evaluation of Army ground combat elements. The report suggests a definition of high proficiency in simulated combat which includes inflicting the maximum casualties on the enemy, sustaining the minimum casualties, achieving effective intra- and inter-unit coordination, and responding adaptively to enemy actions in a dynamic situation. The paper suggests that psychological fidelity or realism in the simulated combat environment is an essential component for effective training.

Combat Developments Experimentation Command. CDEC Military Observations. Tactical Effectiveness of Minefields in the Antiarmor Weapons System (TEMAWS). Report on CDEC Experiment FC026, April 1977.

A summary report based on the TEMAWS Experiment (Tactical Effectiveness of Minefields in the Antiarmor Weapons System). The report provides tactical lessons learned (much like the observations of the 3x5 test, Blalock and Mullis, 1976, and the PARFOX test, Combat Developments Experimentation Command, 1976a) including: antitank weapons were best employed in the overwatch role, smoke aided in breaching minefields but silhouetted vehicles as targets, and vehicle commanders saw over 50 percent of all observed targets but found it very difficult to detect targets while buttoned up.

Erwin, Donald E. and Dai, Kai. Using Communication to Predict Organization Efficacy. Paper presented at the Annual Meeting of the Eastern Psychological Association, Boston, Massachusetts, April 1977.

This is a concept paper on the use of Catastrophe Theory as a method of predicting organizational efficacy as measured by a cost/achievement ratio and making use of communications behavior within members of a group conducting Tactical Engagement Simulation exercises.

Sulzen, Robert H. and Root, Robert T. Engagement Simulation: Development of an Innovative Training System. Paper presented at the Annual Meeting of the American Educational Research Association, New York, April 1977.

This paper is a review and synthesis of the nature and benefits of Tactical Engagement Simulation (TES) training. The dynamic nature and realism of the TES training environment is recounted. A definition of high proficiency is presented (Root and Erwin, 1976) and specific examples are given from a field test (Root, et al, 1976). Task analysis for simple individual training is contrasted with the complexity of task analysis for dynamic collective TES training. The dynamic TES training environment, although intended primarily for collective training, can provide the most appropriate setting for individual training as well.

Erwin, Donald E. and Root, Robert T. Psychological Fidelity in Simulated Combat. Paper presented at the Annual Meeting of the American Psychological Association, San Francisco, California, August 1977.

This document is a paper advocating the use of psychological as opposed to physical fidelity in training to simulate combat for ground forces. The report includes the description of a simulation system formulated with system trainee attitudes toward their combat readiness and their general motivational level after using the system.

Banks, James H., Hardy, Guthrie D., Scott, Thomas D., Kress, Gray and Word, Larry E. REALTRAIN Validation for Rifle Squads: Mission Accomplishment. ARI Research Report 1192, October 1977.

A report on the comparison of rifle squads trained with Tactical Engagement Simulation (SCOPES, called REALTRAIN in ARI reports) and squads trained by conventional field training. Squads trained by each method were pitted against a trained Opposing Force (OPFOR) and against squads trained by the other method. The results showed that before training neither group performed well in terms of mission accomplishment, casualties sustained, or casualties inflicted. Following training, the SCOPES trained squads performed significantly better than during pre-training as measured by mission accomplishment (attack and defense). They also sustained relatively fewer casualties while inflicting relatively more casualties than the conventionally trained squads. Conventionally trained squads performed about the same following training as in the pre-training assessment. The SCOPES trained squads succeeded in mission accomplishment more frequently than the conventionally trained squads when they opposed each other, and they had more favorable casualty exchange ratios.

Word, Larry E. Independent Evaluation Plan for Operational Testing of Multiple Integrated Laser Engagement System (MILES). TRADOC Systems Manager for Tactical Engagement Simulation, Coordinating Draft, February 1978.

This document is a draft of an evaluation plan. The evaluation was actually performed by Milhorn and Manza (1979) using a plan of their own. The value of this document is in the concepts for evaluation of Tactical Engagement Simulation. A series of specific and objective criteria are presented that could be used as measures of tactical performance. The document points out deficits in the ARTEP which have still not been corrected and appends secondary measures of performance that could be used to evaluate a company team conducting a movement to contact mission.

Camm, William B. Commander's Overview Questionnaire Results (REALTRAIN).
Army Research Institute Report, April 1978.

This document reports on a mailed survey of Army Infantry Commanders' views on REALTRAIN I or SCOPES. With an overall return rate of 50 percent, 83 percent of those responding thought that the training was as effective or more effective than conventional training. An analysis of comments received indicated that the majority of Infantry Commanders felt the training was effective but required too much equipment and too many control personnel.

Epstein, Kenneth I. Automated Tactical Operations Measurement System - ATOMS. Paper presented at the Military Operations Research Society 41st Symposium, Fort McNair, Washington, DC, July 1978.

The paper is a description of an attempt to automate a data collection, reduction, and analysis methodology for Tactical Engagement Simulation exercises where the data were collected manually. (See also the following papers: Hamill, 1978; Knerr, Root, and Word 1979; Medlin, 1979c; Root, Knerr, Severino, and Word, 1979; and Sulzen and Stein, 1981.)

Hamill, Bruce W. ATOMS Data Analysis. Paper presented at the Military Operations Research Society 41st Symposium, Fort McNair, Washington, DC, July 1978.

This paper is the second of two related to the Automated Tactical Operations Measurement System (ATOMS) (see also, Epstein, 1978). The variety of data analytic procedures for ATOMS includes analyses to reconstruct individual tactical exercises, structured analyses to determine hypothesized trends across exercises, and statistical analyses across exercises to identify patterns of changes in variables. (See also: Knerr, Root, and Word, 1979; Medlin, 1979c; Root, Knerr, Severino, and Word, 1979; and Sulzen and Stein, 1981.)

Erwin, Donald E. Engagement Simulation Training Systems: Simulation Training in Collective, Man-Ascendant Tactical Environments. Paper presented at the Annual Meeting of the American Psychological Association, Toronto, Canada, August 1978.

This paper reviews the distinctions made between psychological and engineering fidelity for simulation, as well as, man-ascendant and machine-ascendant simulators. In the simulation of combat, emergent situations occur which are not predictable and are difficult to analyze. However, these situations probably provide the best means of training and evaluation for Army units.

Mirabella, Angelo. Criterion-Referenced System Approach to Evaluation of Combat Units. ARI Research Memorandum 78-21, September 1978.

This is a concept paper outlining the research program underway at that time for the evaluation of unit performance making use of Tactical Engagement Simulation. The plan was to develop a model or models, define the data requirements and develop processing methods, develop data collection methods, and develop standards. (See also Johnson and Wheaton, 1981; Johnson, Wheaton, Allen, Forrester, and Sulzen, 1981; the Medlin, 1979 series; Root, Knerr, Severino, and Word, 1979; Sulzen, 1982; Sulzen, Hannaman, Freeble, and Laurence, 1981; Wheaton, Johnson, and Dondero, 1981; and Wheaton, Johnson, Forrester, Dondero, and Sulzen, 1981.)

Meliza, Larry L., Scott, Thomas D. and Epstein, Kenneth I. REALTRAIN Validation for Rifle Squads II: Tactical Performance. ARI Research Report 1203, March 1979.

This report is one in a series of reports on Tactical Engagement Simulation or REALTRAIN validation conducted between 1975 and 1978. It is probably the best single report of its kind and set the pattern for those following. It concerns a series of rifle squad trials (Banks, Hardy, Scott, Kress, and Word, 1977) and provides detailed analyses on the important intermediate tactical performance or process measures observed during the trials. (See also Root, et al, 1976; Scott, Meliza, Hardy, Banks, and Word, 1979; Scott, Banks, Hardy, and Sulzen, 1979; and Scott, Meliza, Hardy, and Banks, 1979.)

Scott, Thomas D., Meliza, Larry L., Hardy, Guthrie D., Banks, James H. and Word, Larry E. REALTRAIN Validation for Armor/Anti-Armor Teams. ARI Research Report 1204, March 1979.

This is one of the REALTRAIN Validation series of reports on Tactical Engagement Simulation effectiveness. This particular report deals with performance measures taken during tank platoon and antiarmor section tactical exercises. When REALTRAIN trained platoons were compared with conventionally trained platoons, the REALTRAIN platoons performed better in terms of mission accomplishment, casualties inflicted and sustained, and in the number of observable measures properly executed. (See also Scott, Meliza, Hardy, and Banks, 1979.)

Havron, M. Dean, McFarling, Leslie H. and Wanschura, Robert G. Improved ARTEP Methods for Unit Evaluation, Volume VI: Conventional ARTEP Missions and Engagement Simulations: An Examination of Options. ARI Technical Report TR-79-A24, April 1979.

This document is a discussion of philosophies and procedures of Tactical Engagement Simulation training methods and conventional ARTEP field exercises. Four issues are examined: development of measures of unit tactical performance, structure and functions of evaluator/controller teams, reduction/integration of both types of data, and the use of the data to assess training progress or establish objectives.

Medlin, Steven M. Behavioral Forecasting for REALTRAIN Combined Arms. ARI Technical Report 365, May 1979b.

This is the first in a series of reports by the same author on the validity of using board war game forecast data to determine standards for units participating in Tactical Engagement Simulation exercises. A series of board war game exercises were carried out with the same scenario on the same terrain as field exercises using REALTRAIN. Comparison of the maneuver routes and casualties revealed that the maneuver routes of the field exercises were slightly more complex than the board game routes, and that the casualty data were very similar to one another. The report concludes that the similarities suggest that board war gaming can be used as a means to develop field performance standards.

Knerr, Claramae S., Root, Robert T. and Word, Larry E. An Application of Tactical Engagement Simulation for Unit Proficiency Measurement. ARI Technical Report 381, July 1979.

This report provides a discussion of methods that might be employed to objectively measure combat proficiency of tactical units employing Tactical Engagement Simulation. Product measures of tactical proficiency are provided by casualty exchange ratios and mission accomplishment. Process measures are provided by observing tactical exercises. (See also Johnson and Wheaton, 1981; Medlin, 1979c; Medlin, et al, 1979; and Wheaton, et al, 1981).

Medlin, Steven M. Combat Operations Training Effectiveness Model: 1979 Perspective. ARI Technical Report 393, July 1979c.

This document is a concept paper on the Combat Operations Training Effectiveness Model (COTEAM). The model is described as including Tactical Engagement Simulation for field evaluation, procedures for defining standards for comparison with field performance, and techniques for assessing training deficiencies and levels of combat readiness. (See also Johnson and Wheaton, 1981; Johnson, Wheaton, Allen, Forrester, and Sulzen, 1981; Root, Knerr, Severino, and Word, 1979; Sulzen, 1982; Sulzen, Hannaman, Freeble, and Laurence, 1981; Sulzen, Root, and Epstein, 1976; Wheaton, Johnson, and Dondero, 1981; and Wheaton, Johnson, Forrester, Dondero, and Sulzen, 1981.)

Scott, Thomas D., Banks, James H., Hardy, Guthrie D. and Sulzen, Robert H. REALTRAIN Validation for Rifle Squads III: Tactical Performance During Movement-to-Contact. ARI Research Report 1213, July 1979.

This is one of the REALTRAIN Validation series of reports on Tactical Engagement Simulation effectiveness. This particular report deals with process measures for rifle squads taken during the movement phase of the mission. The study compared the performance of REALTRAIN and conventionally trained squads and found that the REALTRAIN trained squads performed better on measures of coordinated movement, support, observation and communication/control functions. (See also Banks, Hardy, Scott, Kress, and Word, 1977 and Meliza, Scott, and Epstein, 1979.)

Scott, Thomas D., Meliza, Larry L., Hardy, Guthrie D. and Banks, James H. Armor/Anti-Armor Team Tactical Performance. ARI Research Report 1218, July 1979.

This is one of the REALTRAIN Validation series of reports on Tactical Engagement Simulation effectiveness. This particular report deals with process measures taken during tank platoon and anti-armor section tactical exercises. Successful units were compared with unsuccessful and found to perform better in planning the attack, initial deployment, use of cover and concealment, surveillance and use of firepower. Successful units also frequently detected concealed enemy vehicles, employed antitank weapons to provide effective overwatch for assaulting tank forces and were able to mass tank and antitank firepower on the enemy tanks. (See also Scott, Meliza, Hardy, Banks, and Word, 1979.)

Medlin, Steven M. A Partial Validation of Forecast Engagement Simulation Exercise Outcomes. ARI Technical Report 382, August 1979a.

This is the report of a study on the validity of using board war game forecast data to determine standards for units participating in Tactical Engagement Simulation exercises. Military personnel attempted to distinguish between field exercise data and board war game data, but were unable to do so. In fact, military personnel tended to classify simulated casualty data as real. Based on the research, forecasting procedures could be used to develop performance standards for comparison with field performance. (See also the other reports by Medlin, 1979.)

Root, Robert T., Knerr, Claramae S., Severino, Angelo A. and Word, Larry E. Tactical Engagement Simulation Training: A Method for Learning the Realities of Combat. ARI Technical Paper 370, August 1979.

This paper describes the ideas which led to the development of Tactical Engagement Simulation as a training method. Methods of data collection for field exercises are given and suggested analytical procedures are outlined. Although critical combat tasks may be identified during simulated combat exercises, these tasks may not have to occur in each exercise for successful mission accomplishment. Patterns of task occurrence may serve to explain how or why a particular outcome took place.

Medlin, Steven M., Epstein, Kenneth I., Wanschura, Robert G., Mirabella, Angelo and Boycan, G. Gary. Multiple Integrated Laser Engagement Simulation (MILES) Training and Evaluation Test (TET) Evaluator Guidebook. ARI Research Product 79-11, September 1979.

This document is a guidebook developed for training a senior controller/evaluator and his staff on how to conduct an external Army Training and Evaluation Program (ARTEP) employing Tactical Engagement Simulation with the Multiple Integrated Laser Engagement System (MILES). The instruction includes how to observe a field exercise, what to observe, how to record observations and how to use observations to provide feedback. The guidebook was the basis for the evaluations conducted during the final Operational Test of MILES in the fall of 1979.

Shriver, Edgar L. and Zach, Sarah E. Measuring Training Effectiveness- Procedural Versus Combat Proficiency. Paper presented at the meeting of the Military Testing Association, October 1979.

This concept paper presents an argument that the measurement of combat proficiency is best accomplished through product measures in an appropriate simulated environment. The authors contend that current practices force a procedural emphasis on evaluation which is more appropriate for lower level skills or novice performance. They suggest that task analysis for higher level skills should be conceptual rather than procedural and measurement should focus on products and not processes. Finally, the authors suggest that control of the testing methodology demanding high level proficiency is the answer to control and improvement of training.

Hansen, Duncan N. and Drewfs, Paul. An Evaluation Framework for Tactical Engagement Simulation Training: Combined Arms Developmental Test Assessment. Final Contract Report for ARI. Contract DAHC 19-77-C-0024, 1979.

This report is an attempt to provide an analysis of a combined arms team field test of Tactical Engagement Simulation employing REALTRAIN techniques and a manual data collection system with automated analyses (See Epstein, 1978 and Hamill, 1978). The report was deemed unacceptable by ARI evaluators due to contradictions in data, unlabeled tables and figures, and poor quality of writing. Although the ARI evaluation of the report is correct, the report does suggest some imaginative forms of analysis which have not been pursued. If viewed with caution, the report may provide ideas for creative or alternative forms of analysis of Tactical Engagement Simulation exercises.

Scott, Thomas D. "Tactical Training for Ground Combat Forces," Armed Forces and Society, Volume 6, Number 2, Winter 1980, pp. 215-231.

This is a thoughtful and penetrating article on Tactical Engagement Simulation; its effectiveness as a tactical training system and its poor implementation record. The article provides a summary of the REALTRAIN Validation studies for rifle squads and tank platoons (Banks, Hardy, Scott, Kress, and Word, 1977; Meliza, Scott, and Epstein, 1979; Scott, Banks, Hardy, and Sulzen, 1979; Scott, Meliza, Hardy, and Banks, 1979; and Scott, Meliza, Hardy, Banks, and Word, 1979) which shows the effectiveness of Tactical Engagement Simulation as a training system for combat units. The conclusion of the article is a discussion of the poor implementation of the system and a call for solutions in the training environment.

Medlin, Steven M. and Thompson, Paul. Evaluator Rating of Unit Performance in Field Exercises. ARI Technical Report 438, April 1980.

This is a research report to identify the major dimensions that military evaluators actually use to assess field performance. Fifteen officers rated unit performance in each of 15 narrative descriptions of field exercises. Analysis of these ratings using multidimensional scaling analysis indicated only three dimensions: overall performance, use of indirect fire and use of heavy antitank weapons (TOWs). Other potentially relevant factors seemed to be leadership functions and tactical skills.

Gray, Thomas and Roberts-Gray, Cynthia. A Strategy for Coping with Change. Final Contract Report for ARI, Contract MDA903-78-C-2014, July 1980.

The report is the documentation of a prototype model of organizational change developed for monitoring the implementation of the Multiple Integrated Laser Engagement System (MILES) in the army. The model will be utilized to monitor MILES implementation (see Roberts-Gray, Clovis, Gray, Muller, and Cunningham, 1980 and Roberts-Gray, Muller, and Gray, 1981).

Roberts-Gray, Cynthia, Clovis, E. R., Gray, Thomas, Muller, Thomas H. and Cunningham, Robert F. Field Survey of Current Practices and Problems in Army Unit Training, with Implications for Fielding and Training with the MILES, Volume I. ARI Technical Report 524, May 1981.

This is a report of a field survey of four active Army divisions in the United States about the acceptance and implementation of Tactical Engagement Simulation in the Army. The findings were that REALTRAIN/SCOPES training methods were generally accepted but use was sporadic; that current training practices provide too few resources for training; and, that current practices do not provide incentives for expending the extra effort which is required to implement a new training system such as MILES.

Sulzen, Robert H. The Effects of Repeated Engagement Simulation Exercises on Individual and Collective Performance. ARI Technical Report 485, August 1980.

This report presents some evidence for the learning that takes place for individuals and units during repeated Tactical Engagement Simulation field exercises. The results indicated that soldiers tended to suffer increased casualties when they caused more casualties. The unit became progressively more effective at inflicting casualties, but did not improve in avoiding casualties. There was evidence that defensive positions contributed unequally to casualties inflicted on attackers. (See also Sulzen, Laurence, and Hannaman, 1982.)

Sulzen, Robert H. and Stein, Earl S. Measuring Training Effectiveness in Units: That Elusive Goal. Paper presented at the meeting of the American Educational Research Association, Los Angeles, California, April 1981.

This paper reviews research that had been done as of that time on measuring unit performance with Tactical Engagement Simulation. Specific studies on REALTRAIN Validation, leader training effects on tactical field performance, and forecasting field exercise outcomes from battle simulation are reviewed. The methods of task analysis for unit tactical performance and goal specification are reviewed. The problems of a former evaluation system entitled "ATOMS" (Epstein, 1978) are presented, and the paper concludes with the suggestion that the data available at the National Training Center could potentially provide the necessarily objective input to an efficient unit performance assessment system.

Johnson, Eugene III, and Wheaton, George K. Research on System Analytic Approaches to Unit Evaluation: An Elaboration of the Combat Operations Training Effectiveness Analysis Model (COTEAM). Final Contract Report for ARI, Contract MDA 903-80-C-0187, July 1981.

This report is the description of a methodology for unit evaluation employing Tactical Engagement Simulation involving: the generation of sets of data by simulation to represent satisfactory unit performance under specific scenario conditions; the development of performance measures applicable to field exercise and simulation generated data; the employment of performance variable values from a simulation to define standards; and, the comparison of performance variable values from a field exercise evaluation to the standard values. (See also Johnson, et al, 1981; Medlin, 1979c; Medlin, et al, 1979; Wheaton, Johnson, and Dondero, 1981; and Wheaton, et al, 1981).

Johnson, Eugene III, Wheaton, George R., Allen, Ted W., Forrester, Richard E. and Sulzen, Robert H. Research on Systems Analytic Approaches to Unit Evaluation: Specification of Performance Standards for ES-Based ARTEP. Final Contract Report for ARI, Contract MDA 903-80-C-0187, July 1981.

This report is a study designed to aid in the development of objective standards for the evaluation of units employing Tactical Engagement Simulation. Groups of military judges working together enacted scenario specific tactical exercises from planning to pre-engagement. The exercises were then executed by computer simulation to generate the outcomes that could be expected by a satisfactorily trained unit. (See also, Johnson and Wheaton, 1981; Medlin, et al, 1979; and Wheaton, Johnson, and Dondero, 1981).

Wheaton, George R., Johnson, Eugene III and Dondero, Larry J. Research on Systems Analytic Approaches to Unit Evaluation: Specification of Performance Variables and Measures for ES-Based ARTEP. Final Contract Report for ARI, Contract MDA 903-80-C-0187, July 1981.

This report is the first in a series (see also Johnson and Wheaton, 1981; Johnson, Wheaton, Allen, Forrester, and Sulzen, 1981; and Wheaton, Johnson, Forrester, Dondero, and Sulzen, 1981) on systems analytic approach to unit evaluation which included Tactical Engagement Simulation measures. This report examined front-end analyses, inverted mission analyses, and operations research methodologies as ways for generating performance variables to measure performance in small tactical units. A mission-task analysis was conducted for a company team executing a movement to contact and hasty attack mission.

Wheaton, George R., Johnson, Eugene III, Forrester, Richard E., Dondero, Larry J. and Sulzen, Robert H. Research on Systems Analytic Approaches to Unit Evaluation: Interpretation of Performance Data. Final Contract Report for ARI, Contract MDA 903-80-C-0187, July 1981.

This report includes computer simulation comparisons of previously determined standard mission performance (Johnson, Wheaton, Allen, Forrester, and Sulzen, 1981) and degraded mission performance to determine the sensitivity of the procedure to variations in tactical behavior. Tactical behavior was degraded by having attacking units proceed without smoke cover, leave tanks behind, and oppose a particularly accurate enemy gunner without employing smoke. The degraded tactical behavior was found to be significantly less than standard performance as measured by vehicle loss exchange ratios.

Sulzen, Robert H., Hannaman, David L., Freeble, Jerome D., Jr. and Laurence, Michael T. Combat Operations Training Effectiveness Analysis Model (COTEAM) Applied to Rifle Squad and Platoon Evaluation. ARI Working Paper SS/TA-81-1, August 1981.

This study was an effort to further generalize the Combat Operations Training Effectiveness Analysis Model (COTEAM, see Medlin, 1979c) to lower level tactical units for forecasting (Medlin, 1979a and 1979b) using both war games and the field opposition exercise (FOX, see Shriver, Griffin, Hannaman, and Jones, 1979b). The results indicated that neither the war games nor the FOX were useful for forecasting at the rifle squad level. The FOX may be used to generate tactical performance outcomes that will approximate rifle platoon field exercise outcomes. Methodological difficulties prevent generalization of the platoon war game outcomes to platoon field exercise outcomes. (For other COTEAM research with higher level units and a computer battle simulation see Johnson and Wheaton, 1981.)

Gray, Thomas and Roberts-Gray, Cynthia. A Guide to Implementation of Training Products. ARI Research Report 1350, September 1983.

This document is a guide intended for Army use in the implementation of training devices or products. The guide was developed to fill the void in Army literature which provides methods for developing products, for using products in training, and for evaluating product effectiveness, but provides no guide on implementation. The guide was developed based upon the implementation of MILES (Gray and Roberts-Gray, 1980).

Roberts-Gray, Cynthia, Muller, Thomas H. and Gray, Thomas. Summary Implementation of MILES: Current Status. Final Contract Report for ARI, Contract MDA 903-78-C-2014, October 1981.

This report is a review of the implementation of MILES, (at that time) by survey, field observation and document review. The results indicated that users accepted the MILES devices, but did not employ correctly the MILES control system. The Infantry and Armor Schools had not fully integrated MILES into the school curriculum. The ARTEP did not fully integrate the MILES into evaluation. And, users did not appreciate the benefits that were available when MILES was properly employed.

Dyer, Jean L., Bennett, Robert H. and Sulzen, Robert H. Infantry Squad Operations Orders: Their Characteristics and Role in Mission Success. ARI Draft Technical Report, March, 1982.

This is a study which reviewed and analyzed the oral squad orders of 54 rifle squad leaders given before squad ARTEPs making use of MILES. The best predictor of squad order content was the squad leader's experience. The best predictor of mission outcome was opposing force (OPFOR) experience (see also Sulzen, 1980 and Sulzen, Laurence, and Hannaman, 1982).

Hannaman, David L., Freeble, Jerome D., Jr. and Sulzen, Robert H. The Prediction of Casualty Location in Specific Terrain During Engagement Simulation Training. Paper Presented at the meeting of the American Education Research Association, New York, March 1982.

In this study the location of attacking casualties were predicted from an analysis of the terrain and positions of a defending opposing force (OPFOR). The casualties suffered by 54 attacking squads were plotted and compared with the predictions. The overall prediction accuracy was 76 percent. Potential uses for casualty prediction are suggested for research and evaluation.

Sulzen, Robert H., Laurence, Michael T. and Hannaman, David L. Developing Military Proficiency in Army Tactical Units through Repeated Engagement Simulation Exercises. Paper presented at the meeting of the American Educational Research Association, New York, March 1982.

This is a report on the learning effects of repeated Tactical Engagement Simulation exercises on two groups of three soldiers defending against the successive attacks of 27 rifle squads. The results indicated that the soldiers learned to inflict more casualties on the attackers while suffering fewer casualties. The results conflicted somewhat with an earlier report (Sulzen, 1980); however, the earlier results may be attributed to one individual who was an outlier both statistically and behaviorally.

Sulzen, Robert H. (Ed). Unit Performance Measurement: Proceedings of the ARI Sponsored Seminar, 6-8 October 1981. ARI Working Paper SS/TA-82-1, May 1982.

This document is a collection of papers presented at a seminar on unit performance measurement reviewing military initiatives and research plus a summary of working group reports on directions for future research. Questions considered by the working groups included deficiencies in unit performance measurement and assessment, research that should be undertaken to reduce the deficiencies and methods to improve implementation of research products. The questions were considered for both outcome and process measurement in the context of the National Training Center and home station.

Gray, Thomas, Nichols, Judith J., Roberts-Gray, Cynthia, Ritenour, Thomas and Greisemer, H. Alan. MILES Integration Support Analysis, Phase I: A Look at Army Training 1982. Final Contract Report for ARI. Contract Number MDA 903-82-C-0656, January 1983.

This document reports on the capability of Army tactical units and training centers to implement the Multiple Integrated Laser Engagement System (MILES) in tactical training and in the actual use of the system. A survey was conducted in 20 infantry and armor battalions and at two TRADOC training centers during 1982. The results indicated that the MILES hardware is used routinely, but the employment of the Tactical Engagement Simulation training system is not well understood, accepted or used. Successful implementation of the training system will require command emphasis, improved controller/trainer training, and revised/expanded training doctrine.

Roberts-Gray, Cynthia, Nichols, Judith J. and Gray, Thomas. MILES Integration Support Analysis, Phase II. Final Contract Report for ARI. Contract Number MDA 903-82-C-0656, February 1984.

This report is the second in a series (see Gray, Nichols, Roberts-Gray, Ritenour, and Griesemer, 1983) concerning the implementation of the Multiple Integrated Laser Engagement System (MILES). Observations were made at six military training sites in the United States and Europe. Performance deficits in the implementation of Tactical Engagement Simulation were found in briefing the soldiers on training objectives, recording critical events during exercises and using exercise results to diagnose and conduct exercise repetitions. Similar deficits were found at the Armor and Infantry Schools. The report concluded that the service schools need to improve their training on Tactical Engagement Simulation for the Army at large to have a better implementation of MILES.

THE MOTIVATION PROVIDED BY TACTICAL ENGAGEMENT SIMULATION

Almost all who have observed Tactical Engagement Simulation exercises conducted have been struck by the deep involvement of the participating soldiers. Many of the previously cited documents have devoted lengthy comments to the motivational aspects of Tactical Engagement Simulation when their purpose had been to report on some other phenomena. The research described in the reports contained in this chapter was conducted to measure the motivational effects of Tactical Engagement Simulation.

Holz, Robert F. and Segal, David R. The Impact of a Combat Training System on Personnel Resources in the U.S. Army. Paper presented at the NATO SPPOSS Conference on Military Field Trials and Exercises, Bruxelles, Belgium, September 1975.

The report compares the responses of two similar groups, one of which received Tactical Engagement Simulation training. The training appears to have had a marked positive effect on the morale, attitudes and motivations of the participants. Tactical Engagement Simulation had the effect of increasing job satisfaction, esprit de corps and perception of unit combat readiness on the part of the participant soldiers. (For other motivation research, see the following: Bleda, 1979; Sulzen and Bleda, 1979; and Whitmarsh, 1983.)

Bleda, Paul R. and Hayes, John F. Impact of REALTRAIN and Conventional Combined Arms Exercises on Participant Morale. ARI Technical Paper 308, August 1978.

The study made a comparison of soldier morale in combined arms units participating in Tactical Engagement Simulation (REALTRAIN) exercises versus those found in conventional exercises. The REALTRAIN exercise participants were positive on six of the nine morale components of a questionnaire. The conventional exercise participants were positive on one component of the questionnaire and negative on six.

Bleda, Paul R. "REALTRAIN: A Critique," Army, Volume 28, Number 11, November 1978, pp. 34-37.

This article is a modified version of ARI Technical Paper 363 (Bleda, 1979).

Sulzen, Robert H. and Bleda, Paul R. Effects of Combat Simulation on the Work-Related Motivation/Satisfaction of Participants, ARI Technical Paper 351, March 1979.

This report documents the attitudinal effects that participation in Tactical Engagement Simulation (TES) exercises at the squad level had upon soldiers as compared to a control group participating in conventional exercises. TES was found to favorably enhance the motivation and satisfaction responses of participants in four of the six components of their work experience. Conventional training did not positively influence any of the work related responses of soldiers but, rather, had a depressing effect on one.

Bleda, Paul R. REALTRAIN Improves Soldier Attitudes Toward the Army. ARI Technical Paper 363, May 1979.

A brief description of the differences between Tactical Engagement Simulation (REALTRAIN) and conventional training is provided. The results of two previous studies (Bleda and Hayes, 1978; Sulzen and Bleda, 1979) are reviewed, and a conclusion is made that a volunteer force could be better maintained through motivation gained by making use of realistic field combat simulation. (Other motivation studies include Bleda and Hayes, 1978; Holz and Segal, 1975; and Whitmarsh, 1983.)

Bleda, Paul R. and Sulzen, Robert H. "The Effects of Simulated Infantry Combat Training on Motivation and Satisfaction," Armed Forces and Society, Volume 6, Number 2, Winter 1980, pp. 202-214.

This publication is a refinement for a more diversified audience of ARI Technical Paper 351 (Sulzen and Bleda, 1979).

Burchard, Hank. "Oh, What a Lovely War!" The Washington Post, Weekend Section, 18 March 1983, pp. 5-6.

This is a press report on The Survival Game which makes use of an air pistol fired dye pellet for games conducted much like Tactical Engagement Simulation exercises. There are interesting parallels between these civilian run games and Tactical Engagement Simulation exercises in terms of the dynamic nature of the experience, the motivation of the participants and the rapid rate of learning. (See also, Owen, 1983.)

Owen, Elizabeth. "Fun and War Games in the Woods," Life, Volume 6, Number 5, May 1983, pp. 68-72.

This is a photo-journalistic article describing a popular game played on weekends by civilians that includes many of the characteristics of Tactical Engagement Simulation. The game makes use of an air pistol (that fires a dye filled pellet marking "kills") and goggles for eye safety. The game is called the National Survival Game and is played like Capture the Flag with the inclusion of casualty assessment. (See also Burchard, 1983.)

Whitmarsh, Patrick J. An Assessment of Job Satisfaction of Combat Arms Personnel During REALTRAIN Training. ARI Technical Report 597, November 1983.

This report on survey measured motivation related to Tactical Engagement Simulation (TES) is the latest in a series (Holtz and Segal, 1975; Bleda and Hayes, 1978; and Sulzen and Bleda, 1979). Each study compares the attitudes of those receiving TES with those not receiving TES on similar or identical survey items. Although some factors were found to be significant in one study, in another study they were not. The one exception is the factor dealing with the effect of TES training on readiness which, in every case, is positive. The conclusion to be drawn is that Tactical Engagement Simulation (TES) training has a consistent and significantly positive effect on the attitudes of participants.

BIBLIOGRAPHY

1. Actkinson, Tomme R. Human Factors Evaluation of the Multiple Integrated Laser Engagement System in an Operational Environment. ARI Research Report 1322, November 1980.
2. Agnew, James B. "The National Training Center: The Next Thing to the Ultimate Realism," Army, Volume 30, Number 2, February 1980, pp. 30-36.
3. Anderson, John and Sherwood, Edward. "REALTRAIN" Infantry, Volume 65, Number 1, January-February 1975, pp. 20-23.
4. Arthur D. Little, Inc. Technical Evaluation of Four Dynamic Training Devices. Final Contract Report for US Army Combat Arms Training Board, Contract Number DAHG 19-72-C-0032, February 1973.
5. Banks, James H., Hardy, Guthrie D., Scott, Thomas D., Kress, Gary and Word, Larry E. REALTRAIN Validation for Rifle Squads: Mission Accomplishment. ARI Research Report 1192, October 1977.
6. Barber, Herbert F. and Solick, Robert E. MILES Training and Evaluation Test, USAREUR: Battalion Command Group Training. ARI Research Report 1290, June 1980.
7. Beatrice, Edwin S., Lund, David J., Cours, David, Wampner, Paul and Sliney, David H. Project MILES: Biomedical Research and Coordination in Safe Field Exercises. Proceedings of Army Science Conference, Volume One. West Point, New York, June 1977, pp. 95-103.
8. Binder, L. James. "The War is Never Over At Fort in the Mojave," Army, Volume 33, Number 4, April 1983, pp. 30-35.
9. Black, Ira W., Blalock, Darrell N., Bosma, Phillip H., Mullis, Harry E., McDonald, Jerome P. and Fleisher, Kenneth E. Three-Tank Platoon Versus Five-Tank Platoon. TRADOC Combined Army Test Activity (TCATA) Test Report Number TT 1085, November 1976.
10. Blalock, Darrell N. and Mullis, Harry E. Impact of Realism in Field Exercises. TRADOC Combined Arms Test Agency observations from the Three-Tank versus Five-Tank (3x5) Test, November 1976.
11. Bleda, Paul R. "REALTRAIN: A Critique," Army, Volume 28, Number 11, November 1978, pp. 34-37.
12. Bleda, Paul R. REALTRAIN Improves Soldier Attitudes Toward the Army. ARI Technical Paper 363, May 1979.
13. Bleda, Paul R. and Hayes, John F. Impact of REALTRAIN and Conventional Combined Arms Exercises on Participant Morale. ARI Technical Paper 308, August 1978.

14. Bieda, Paul R. and Sulzen, Robert H. "The Effects of Simulated Infantry Combat Training on Motivation and Satisfaction," Armed Forces and Society, Volume 6, Number 2, Winter 1980, pp. 202-214.
15. Board for Dynamic Training. Training Techniques and Devices Considered by Administrative Committee. Final Report, Volume VI, Annex J (Committee Reports), December 1971, pp. J-919 to J-942.
16. Boersema, Jim. "A National Training Center Blooming in the Desert," Soldiers, Volume 35, Number 7, July 1980, pp. 18-22.
17. Bosley, John J., Blanton, Robert, Onoszko, Peter W. J., Knerr, Claramae S. and Root, Robert T. Tactical Engagement Simulation Training Techniques: REALTRAIN for Armored Cavalry. ARI Research Product 79-1, January 1979a.
18. Bosley, John J., Blanton, Robert, Onoszko, Peter W. J., Knerr, Claramae S. and Root, Robert T. Tactical Engagement Simulation Training Techniques: Two Training Programs for the Conduct of After Action Reviews. ARI Research Product 79-2, January 1979b.
19. Brown, Michael. "Learning the Hard Way," Soldiers, Volume 39, Number 2, February 1984a, pp. 14-19.
20. Brown, Michael. "Live from NTC - It's the War," Soldiers, Volume 39, Number 2, February 1984b, pp. 26-28.
21. Brown, Michael. "The Eyes of the Battle," Soldiers, Volume 39, Number 2, February 1984c, pp. 24-25.
22. Burchard, Hank. "Oh, What a Lovely War!" The Washington Post, Weekend Section, 18 March 1983, pp. 5-6.
23. Camm, William B. Commanders Overview Questionnaire Results (REALTRAIN). Army Research Institute Report, April 1978.
24. Chaney, Mark and Cannon, Michael W. "Improving Combat Skills -- The National Training Center," Armor, Volume 90, Number 2, March-April 1981, pp. 37-41.
25. Clark, R. N., Charlet, J. D., Criswell, D. L. and Bird, S. M. National Training Center Instrumented Training Demonstration (NTC1A). Final Contract Report for US Army Missile Command, Contract DAAK 40-79-C-0091, May 1980.
26. Clark, Robert L. "MILES Gladiator Training," Army Trainer, Volume 3, Number 1, Fall 1983, pp. 50-52.
27. Clovis, E. R. and Muller, T. H. Development of Procedures for Evaluating Unit Performance. Final Contract Report for ARI, two Volumes. Contract DAHC 19-73-C-0055, March 1975.

28. Combat Developments Experimentation Command. CDEC Military Observations. Tactical Effectiveness of Minefields in the Antiarmor Weapons System (TEMAWS). Report on CDEC Experiment FC026, April 1977.
29. Combat Developments Experimentation Command. CDEC Observations and Military Judgements. Evaluation of the Parapet Foxhole, Part 7 (PARFOX VII). Report on CDEC Experiment FC033, December 1976.
30. Combat Developments Experimentation Command. Evaluation of the Frontal Parapet Foxhole, Part 7 (PARFOX VII). Final Report CDEC Experiment FC033, October 1976.
31. Combat Developments Experimentation Command. Evaluation of the Frontal Parapet Foxhole, Part 7 (PARFOX VII), Supplement 1, Data Package, Volume I. Report on CDEC Experiment FC033, November 1976.
32. Combat Developments Experimentation Command. Evaluation of the Frontal Parapet Foxhole, Part 7 (PARFOX VII), Supplement 1, Data Package, Volume II. Report on CDEC Experiment FC033, November 1976.
33. Combat Developments Experimentation Command. Evaluation of the Frontal Parapet Foxhole, Part 7 (PARFOX VII), Supplement 1, Data Package, Volume III. Report on CDEC Experiment FC033, November 1976.
34. Combat Developments Experimentation Command. NTC 1A - Stages IV and V Test Observation Report. Final Report TRADOC TRMS Number FC 096, May 1980.
35. Combat Developments Experimentation Command. Tactical Effectiveness Testing of Antitank Missiles (TETAM), Volume VIII: Phase III. Final Report. CDEC Experiment 11.8, February 1974.
36. Combat Developments Experimentation Command. Tactical Effectiveness Testing of Antitank Missiles (TETAM), Volume IX, Phase III, Data Package. Final Report on CDEC Experiment 11.8, February 1974.
37. Combat Developments Experimentation Command. Training Instrumentation Evaluation (TIE). Final Report on CDEC Experiment FC 095, December 1978.
38. Combined Arms Center. Combined Arms Training Tips, Volume 1, Number 1, August 1982.
39. Combined Arms Center. Combined Arms Training Tips, Volume 2, Number 1, October 1983.
40. Combined Arms Center. Combined Arms Training Tips, Volume 2, Number 2, December 1983.
41. Combined Arms Center. Combined Arms Training Tips, Volume 2, Number 3, March 1984.
42. Commanders Guide to Tactical Engagement Simulation with MILES, Pamphlet, approximately Fall 1981.

43. Cunningham, R. F., Muller, E. R. and Clovis, E. R. Planning a Combined Arms Unit Training Research and Evaluation Test Bed. Final Contract Report for ARI. Contract Number DAHC 19-73-C-0055, October 1974.
44. DeGraf, William B., Erickson, David L., Hansen, Duncan N. and Stringfellow, Charles C. Report of Findings on National Training Center Functional Design and Development Schedules. Final Contract Report for the Defense Advanced Research Projects Agency (DARPA), Contract Number DAAK 40-78-C-0198, December 1978.
45. Department of the Army, Headquarters, 2d Brigade, 3d Armored Division, "MILES Sniper After Action Report," 3d Armored Division Letter Report, March 1982.
46. Department of the Army, Graphic Training Aid 25-6-1. MILES Instructor's Lesson Plan Booklet. Washington, DC, November 1982.
47. Department of the Army, Graphic Training Aid 25-6-7. Instructor's Controller Training Guide. Washington, DC, February 1984.
48. Department of the Army, Graphic Training Aid 25-6-9. Instructor's MILES Infantry Systems Training Guide. Washington, DC, February 1984.
49. Department of the Army, Graphic Training Aid 25-6-8. Instructor's MILES Tank System Training Guide. Washington, DC, February 1984.
50. Department of the Army, Graphic Training Aid 25-6-2. MILES Infantry Field Controller's Guide. Washington, DC, November 1982.
51. Department of the Army, Graphic Training Aid 25-6-3. MILES Armor Field Controller's Guide. Washington, DC, November 1982.
52. Department of the Army, Training Circular 25-6, Tactical Engagement Simulation Training with MILES, Washington, DC, September 1982.
53. Dick, Scott A. "Mechanized MILES," Army Trainer, Volume 2, Number 3, Spring 1983, pp. 53-55.
54. Downing, Wayne A., Riley, James R. and Rodriguez, David M. "Training for Maneuver Warfare," Military Review, Volume 64, Number 1, January 1984, pp. 16-27.
55. Dunipace, Norma E., Henderson, Lewis, Smart, Kenneth G. Final Report for the NTC Take Home Package. Final Contract Report for ARI. Contract Number MDA 903-82-C-0656, February 1984.
56. Dyer, Jean L., Bennett, Robert H. and Sulzen, Robert H. Infantry Squad Operations Orders: Their Characteristics and Role in Mission Success. ARI Draft Technical Report, March, 1982.
57. Edwards, Richard I. National Training Center Developmental Plan. Unofficial Document published by TRAINOC Systems Manager for the National Training Center, April 1979.

58. EFFTRAIN Research Evaluation Conducted at Fort Lewis, Washington.
Contract Report for ARI. Contract Number DAHC 19-74-C-0024, October 1974.
59. Ellis, Junius. "Laser War in the Mojave," Science Digest, Volume 91, Number 8, August 1983, pp. 44-53.
60. Epstein, Kenneth I. Automated Tactical Operations Measurement System - ATOMS. Paper presented at the Military Operations Research Society 41st Symposium, Fort McNair, Washington, DC, July 1978.
61. Erwin, Donald E. Development and Use of Evaluative Criteria for Comparing Models of Unit Performance. Paper presented at the meeting of the Military Testing Association, Gulf Shores, Alabama, October 1976.
62. Erwin, Donald E. Engagement Simulation Training Systems: Simulation Training in Collective, Man-Ascendant Tactical Environments. Paper presented at the Annual Meeting of the American Psychological Association, Toronto, Canada, August 1978.
63. Erwin, Donald E. "Training Simulations for Air-Ground Combat," Army R,D & A, Volume 20, Number 4, July-August 1979, pp. 20-21.
64. Erwin, Donald E. and Dai, Kai. Using Communication to Predict Organization Efficacy. Paper presented at the Annual Meeting of the Eastern Psychological Association, Boston, Massachusetts, April 1977.
65. Erwin, Donald E. and Root, Robert T. Psychological Fidelity in Simulated Combat. Paper presented at the Annual Meeting of the American Psychological Association, San Francisco, California, August 1977.
66. Erwin, Donald E. and Stein, Earl S. "AGES: Realistic Tactical Training for Air Defenders," Air Defense Magazine, July-September 1979.
67. Fetig, James. "No Slack at the NTC," Army Trainer, Volume 1, Number 4, Summer 1982, pp. 24-27.
68. Fetig, James. "NTC Desert Tips," Army Trainer, Volume 2, Number 2, Winter 1982, pp. 18-20.
69. Fobes, James L. The Army Research Institute Unit Performance Research and Development Center. ARI Research Note 85-97, June 1985.
70. Fobes, James L. National Training Center Data Handbook. ARI Research Product 84-17, July 1984.
71. Garamone, Jim. "Laser Combat," The Pentagon News, 26 March 1981, pp. 20-21.

72. Gardiner, K. W., Fraser, E. C., Pressman, G. L. and Northend, C. A. Direct Fire Simulation System. Final Contract Report for CDEC, Contract DA-04-200 AMC-1884 (X), October 1966.
73. Glasgow, Matt. "Quick or Dead? MILES Tells Which One You'll Be," Soldiers, Volume 35, Number 7, July 1980, pp. 11-12.
74. Glasgow, Matt. "Troops Go for MILES," Soldiers, Volume 36, Number 6, June 1981, pp. 49-52.
75. Gorman, Paul F. "Engagement Simulation" First International Learning Technology Congress and Exposition on Applied Learning Technology, Proceedings Volume IV, Society for Applied Learning Technology, Washington, DC, July 1976a, pp. 136-141.
76. Gorman, Paul F. Toward a Combined Arms Training Center. TRADOC Concept Paper, November 1976b.
77. Gray, Thomas, Nichols, Judith J., Roberts-Gray, Cynthia, Ritenour, Thomas and Greisemer, H. Alan. MILES Integration Support Analysis, Phase I: A Look at Army Training 1982. Final Contract Report for ARI. Contract Number MDA 903-82-C-0656, January 1983.
78. Gray, Thomas, Roberts-Gray, Cynthia and Gray, Wayne D. A Guide to Implementation of Training Products. ARI Research Report 1350, September 1983.
79. Gray, Thomas and Roberts-Gray, Cynthia. A Strategy for Coping with Change. Final Contract Report for ARI, Contract MDA 903-78-C-2014, July 1980.
80. Gray, Wayne D. "Engagement Simulation: A Method of Tactical Team Training," Training and Development Journal, Volume 37, Number 7, July 1983, pp. 29-31, 33-34.
81. Hamill, Bruce W. ATOMS Data Analysis. Paper presented at the Military Operations Research Society 41st Symposium, Fort McNair, Washington, DC, July 1978.
82. Hannaman, David L., Freeble, Jerome D., Jr. and Sulzen, Robert H. "One-on-One Tactical Training," Infantry, Volume 72, Number 3, May-June 1982, pp. 30-34.
83. Hannaman, David L., Freeble, Jerome D., Jr. and Sulzen, Robert H. The Prediction of Casualty Location in Specific Terrain During Engagement Simulation Training. Paper Presented at the meeting of the American Education Research Association, New York, March 1982.
84. Hansen, Duncan N. and Drewfs, Paul. An Evaluation Framework for Tactical Engagement Simulation Training: Combined Arms Developmental Test Assessment. Final Contract Report for ARI. Contract DAHC 19-77-C-0024, 1979.
85. Hardy, Guthrie D. "Trip Report - Exercise Brave Shield XIV, Yakima Firing Center, Washington," Memorandum for File, ARI Field Unit, Presidio of Monterey, September 1976.

86. Harvey, Charles. "Pound Foolish?" Infantry, Volume 69, Number 5, September-October 1979, pp. 37-38.
87. Havron, M. Dean, McFarling, Leslie H. and Wanschura, Robert G. Improved ARTEP Methods for Unit Evaluation, Volume VI: Conventional ARTEP Missions and Engagement Simulations: An Examination of Options. ARI Technical Report TR-79-A24, April 1979.
88. Hayes, John F., Griffin, Glenn R. and Mathers, Boyd L. Development of Performance Based Proficiency Tests for Combat Arms Skills. Final Contract Report for ARI, Contract Number DAHC19-73-C-0016, May 1974.
89. Hayslett, Jerriane. "The Russians are Here," The Times Magazine, 5 March 1984, pp. 36-39.
90. Henriksen, Kermit F., Jones, Donald R., Jr., Hannaman, David L., Wylie, Peter B., Shriver, Edgar L., Hamill, Bruce W. and Sulzen, Robert H. Identification of Combat Unit Leader Skills and Leader-Group Interaction Processes. ARI Technical Report 440, January 1980.
91. Hines, Paul. "Old Guard Takes to Woods for Laser War ARTEP," Army Times, 13 April 1981, pp. 16-17.
92. Hofer, Ronald C. "Training Devices for the Army," National Defense, Volume 64, Number 358, February 1980, pp. 24-27 & 47.
93. Holz, Robert F. and Segal, David R. The Impact of Combat Training System on Personnel Resources in the U.S. Army. Paper presented at the NATO SPPOSS Conference on Military Field Trials and Exercises, Bruxelles, Belgium, September 1975.
94. Humphrey, Vernon W., Jr. "Getting Ready for NTC: Desert Navigation," Army Trainer, Volume 3, Number 1, Fall 1983, pp. 32-34.
95. Humphrey, Vernon W., Jr. "Winning at the NTC: Reconnaissance," Infantry, Volume 74, Number 1, January-February 1984, pp. 35-37.
96. Humphrey, Vernon W., Jr. "Winning at the NTC: The Fight in the Gullies," Infantry, Volume 73, Number 6, November-December 1983, pp. 31-33.
97. Johnson, Eugene III, and Wheaton, George R. Research on System Analytic Approaches to Unit Evaluation: An Elaboration of the Combat Operations Training Effectiveness Analysis Model (COTEAM). Final Contract Report for ARI, Contract MDA 903-80-C-0187, July 1981.
98. Johnson, Eugene III, Wheaton, George R., Allen, Ted W., Forrester, Richard E. and Sulzen, Robert H. Research on Systems Analytic Approaches to Unit Evaluation: Specification of Performance Standards for ES-Based ARTEP. Final Contract Report for ARI, Contract MDA 903-80-C-0187, July 1981.

99. Johnston, Rico. "MILES: A Laser System that Lets Soldiers Make their Mistakes and Learn from them Before they Play for Keeps," Army Trainer, Volume 1, Number 2, Winter 1981-1982, pp. 26-28.
100. Keating, John M. and Gamarino, Rudolph R. "An Advance Combat Training System Using Laser Simulation," National Defense, May-June 1982, pp. 31-32 & 38.
101. Keating, John M. and Gamarino, Rudolph R. "Laser Battlefield Simulation Reaches New Levels of Sophistication," Military Electronics/Counter-measures, February 1983, pp. 40-42.
102. Keays, Ann. "National Training Center," Army Trainer, Volume 1, Number 2, Winter 1981-1982, pp. 5-9.
103. King, Francis, Stein, Earl S., Sevilla, Exequiel R., Jr. and Seed, Richard J., III. Artillery Engagemen* Simulation. ARI Reserach Report 1245, May 1980.
104. Knerr, Claramae S., Hamill, Bruce W. and Severino, Angelo, A. Engagement Simulation for Armored Cavalry: Initial Test. ARI Research Problem Review 78-5, August 1978.
105. Knerr, Claramae S., Root, Robert T. and Word, Larry E. An Application of Tactical Engagement Simulation for Unit Proficiency Measurement. ARI Technical Report 381, July 1979.
106. Kress, Gary, Bradshaw, Stephen C., McFarland, Robert L. and Ashle Jerry L. ARI Prototype Small Gun Laser Engagement System. AI Technical Paper 318, November 1978.
107. "Laser Bullets Score a Hit in the Battlefield Training," The Pentagonam News, 21 May 1981, p. 15.
108. Lottis, Donald D. "MILES," Infantry, Volume 70, Number 1, January-February 1980, pp. 42-44.
109. Lund, David J., Stuck, Bruce E. and Beatrice, Edwin S. Biological Research in Support of Project MILES. Letterman Army Institute of Research Report Number 96, Presidio of San Francisco, California, July 1981.
110. MacFarlane, Douglas E. "SCOPES: My Introduction," Infantry, Volume 64, Number 5, September-October 1974, pp. 29-31.
111. Mancus, Peter. "Top Gun: A Look at the Navy's Graduate Fighter Pilot School Leading to a Ph.D. in Combat Survival!" Airpower, Volume 12, Number 3, May 1982, pp.16-33.
112. Mathers, Boyd L., Shriver, Edgar L., Root, Robert T., Word, Larry E., Whitter, David W. and Griffin, Glenn R. Training Manager's Handbook for Situational Training. Final Contract Report for ARI, Contract DAHC 19-73-C-0017, November 1973.

113. McFann, Howard H. and Avant, T. Roy. Candidate Applications Analyses for the ARI/NTC Data Base. Research Note 83-42, November 1983.
114. Medlin, Steven M. A Partial Validation of Forecast Engagement Simulation Exercise Outcomes. ARI Technical Report 382, August 1979a.
115. Medlin, Steven M. Behavioral Forecasting for REALTRAIN Combined Arms. ARI Technical Report 365, May 1979b.
116. Medlin, Steven M. Combat Operations Training Effectiveness Model: 1979 Perspective. ARI Technical Report 393, July 1979c.
117. Medlin, Steven M., Epstein, Kenneth I., Wanschura, Robert G., Mirabella, Angelo and Boycan, G. Gary. Multiple Integrated Laser Engagement Simulation (MILES) Training and Evaluation Test (TET) Evaluator Guidebook. ARI Research Product 79-11, September 1979.
118. Medlin, Steven M. and Thompson, Paul. Evaluator Rating of Unit Performance in Field Exercises. ARI Technical Report 438, April 1980.
119. Meliza, Larry L., Scott, Thomas D. and Epstein, Kenneth I. REALTRAIN Validation for Rifle Squads II: Tactical Performance. ARI Research Report 1203, March 1979.
120. Mennig, John J. "Combined Arms Training Notes," Army Trainer, Volume 2, Number 1, Fall 1982, pp. 30-33.
121. Mennig, John J. "Combined Arms Training Notes," Army Trainer, Volume 2, Number 2, Winter 1982, pp. 30-33.
122. Mennig, John J. "Combined Arms Training Notes," Army Trainer, Volume 2, Number 3, Spring 1983, pp. 34-37.
123. Mennig, John J. "Combined Arms Training Notes," Army Trainer, Volume 2, Number 4, Summer 1983, pp. 30-32.
124. Mennig, John J. "Combined Arms Training Notes," Army Trainer, Volume 3, Number 1, Fall 1983, pp. 28-31.
125. Mennig, John J. "Combined Arms Training Notes," Army Trainer, Volume 3, Number 2, Winter 1983, pp. 30-33.
126. Milhorn, Charles L. and Manza, Peter F. Independent Evaluation Report of the Operational Test II for the Multiple Integrated Laser Engagement System (MILES). Combined Arms Training Developments Activity (CATRADA) Final Report ACN47417, February 1979.
127. Mirabella, Angelo. Criterion-Referenced System Approach to Evaluation of Combat Units. ARI Research Memorandum 78-21, September 1978.
128. Modern Army Selected Systems Test Evaluation and Review (MASSTER). Official Weapons Engagement Scoring System (WESS) Mini Test, MASSTER Test Report, June 1975.

129. Munera, Antonio, III. The Multiple Integrated Laser Engagement System (MILES) and the TOW ARTEP. A Thesis presented to the Faculty at the US Army Command and General Staff college in Fort Levenworth, Kansas, June 1977.
130. O'Neal, Russell D., Clark, Christine E., Erwin, Donald E., Freedman, Jerome, Langendorf, Richard M., Miller, James G., Peden, Irene C. and Sidwell, P. Phillip. Army Science Board (ASB) Ad Hoc Sub-Group Report on the National Training Center, March 1981.
131. Owen, Elizabeth. "Fun and War Games in the Woods," Life, Volume 6, Number 5, May 1983, pp. 68-72.
132. Ozolek, David J. "Infantry in Desert Armor Operations," Armor, Volume 92, Number 5, September-October 1983, pp. 26-29.
133. Partheymeuller, Richard R. Concept Evaluation of Simulation of Area Weapons Effects. TRADOC Combined Arms Test Activity (TCATA) Letter Report CEP-106, July 1983.
134. Pulliam, Robert and Mathers, Boyd L. Simulation of Combat as a Measure of Individual Proficiency. Paper presented at the Meeting of the Military Testing Association, Gulf Shores, Alabama, October 1976.
135. Rice, Charlie W. and Woodruff, Charles L. Weapons Engagement Scoring System (WESS) Brave Shield XIV. TRADOC Combined Arms Test Activity (TCATA) Test Report Number TEP 2024, November 1976.
136. Roberts-Gray, Cynthia, Clovis, E. R., Gray, Thomas, Muller, Thomas H. and Cunningham, Robert F. Field Survey of Current Practices and Problems in Army Unit Training, with Implications for Fielding and Training with the MILES, Volume I. ARI Technical Report 524, May 1981.
137. Roberts-Gray, Cynthia, Muller, Thomas H. and Gray, Thomas. Summary Implementation of MILES: Current Status. Final Contract Report for ARI, Contract MDA 903-78-C-2014, October 1981.
138. Roberts-Gray, Cynthia, Nichols, Judith J. and Gray, Thomas. MILES Integration Support Analysis, Phase II. Final Contract Report for ARI. Contract Number MDA 903-82-C-0656, February 1984.
139. Robertson, J.A. How to Plan, Prepare, and Conduct MILES Training Using the Squad Leader's Combat Laser Course. Soldiers Needs Division, High Technology Test Bed, Fort Lewis, Washington, 1982.
140. Rogers, Glenn F., Jr. and Hackney, Michael S. "MILES Sniper Training," Infantry, Volume 73, Number 2, March-April 1983, pp. 20-23.
141. Root, Robert T., Epstein, Kenneth I., Steinheiser, Frederick H., Hayes, John F., Wood, Shelton E., Sulzen, Robert H., Burgess, George G., Mirabella, Angelo, Erwin, Donald E. and Johnson, Eugene, III. Initial Validation of REALTRAIN with Army Combat Units in Europe. ARI Research Report 1191, October 1976.

142. Root, Robert T. and Erwin, Donald E. Engagement Simulation: A Training Environment for the Learning of Complex Tactical Skills. Paper presented at the Military Operations Research Society 38th Symposium, Fort Eustis, Virginia, December 1976.
143. Root, Robert T., Hayes, John F., Word, Larry E., Shriver, Edgar L. and Griffin, Glenn R. Field Test of Techniques for Tactical Training of Junior Leaders in Infantry Units (Project EFFTRAIN). ARI Technical Report 79-A21, July 1979.
144. Root, Robert T., Knerr, Claramae S., Severino, Angelo A. and Word, Larry E. Tactical Engagement Simulation Training: A Method for Learning the Realities of Combat. ARI Technical Paper 370, August 1979.
145. Root, Robert T. and Word, Larry E. Development of a Test Bed for Evaluation of Small Unit Doctrinal Alternatives in the Combat Arms. Paper presented at the 1974 Army Science Conference, West Point, New York, June 1974.
146. Rosen, Melvin H., Chiorini, John R., Hill, Howard G., and MacNaughton, Bryce T. Development of a Combat Unit Evaluation System (CUES), Two Volumes. Final Contract Report for ARI. Contract Number DAHC 19-75-C-0029, April 1976.
147. Kuegemaer, Alan E. Concept Evaluation for the Tank Weapon Gunnery Simulation System (TWGSS). US Army Armor and Engineer Board Final Report TRADOC TRMS Number O-CEP034, November 1982.
148. Scott, Thomas D. Tactical Engagement Simulation After Action Review Guidebook, ARI Research Product 83-18, September 1983.
149. Scott, Thomas D. "Tactical Training for Ground Combat Forces," Armed Forces and Society, Volume 6, Number 2, Winter 1980, pp. 215-231.
150. Scott, Thomas D., Banks, James H., Hardy, Guthrie D. and Sulzen, Robert H. REALTRAIN Validation for Rifle Squads III: Tactical Performance During Movement-to-Contact. ARI Research Report 1213, July 1979.
151. Scott, Thomas D., Meliza, Larry L., Hardy, Guthrie D. and Banks, James H. Armor/Anti-Armor Team Tactical Performance. ARI Research Report 1218, July 1979.
152. Scott, Thomas D., Meliza, Larry L., Hardy, Guthrie D., Banks, James H. and Word, Larry E. REALTRAIN Validation for Armor/Anti-Armor Teams. ARI Research Report 1204, March 1979.
153. Sevilla, Exequiel R., Jr. Tactical Engagement Simulation Training Techniques: Indirect Fire Simulation Procedures. ARI Research Product 79-3, January 1979.
154. Shriver, Edgar L. Task Analysis for Combat Arms. First International Learning Technology Congress & Exposition on Applied Learning Technology, Proceedings, Volume II, Society for Applied Learning Technology, Washington, DC, July 1976, pp. 8-11.

155. Shriver, Edgar L. Two Sided Engagement Training. Paper presented at the Conference on Application of Advanced Training Technology, Fort Gordon, Georgia, June 1975.
156. Shriver, Edgar L. Ratio of Forces Techniques for Scoring Units in Combat Simulations, Paper presented at the Meeting of the Military Testing Association, Gulf Shores, Alabama, October 1976.
157. Shriver, Edgar L., Griffin, Glenn R., Hannaman, David L. and Jones, Donald R. Small Combat Arms Unit Leader Training Techniques: Rules of Play for Two Player/Multiplayer Infantry Mapboard Games. ARI Research Product 79-4, January 1979a.
158. Shriver, Edgar L., Griffin, Glenn R., Hannaman, David L. and Jones, Donald R. Small Combat Arms Unit Leader Training Techniques: Rules of Play for Infantry Field Opposition Exercise. ARI Research product 79-5, January 1979b.
159. Shriver, Edgar L., Griffin, Glenn R., Hannaman, David L. and Jones, Donald R. Small Combat Arms Unit Leader Training Techniques: Rules of Play for Combined Arms Mapboard Game. ARI Research Product 79-6, January 1979c.
160. Shriver, Edgar L., Griffin, Glenn R., Hannaman, David L., Jones, Donald R., and Eden, Mark. Development of Training Test Situations for Small Units: Field Tryout of the EFFTRAIN Training Model in the Berlin Brigade, 1975. Contract Report for ARI. Contract Number DAHC 19-75-C-0030, August 1975.
161. Shriver, Edgar L., Jones, Donald R., Jr., Hannaman, David L., Griffin, Glenn R. and Sulzen, Robert H. Development of Combat Arms Small Unit Leader Tactical Training Techniques and a Model Training System. ARI Research Report 1219, July 1979.
162. Shriver, Edgar L., Mathers, Boyd L., Griffin, Glenn R., Jones, Donald R., Word, Larry E., Root, Robert T. and Hayes, John F. REALTRAIN: A New Method for Tactical Training of Small Units. ARI Technical Report S-4, December 1975.
163. Shriver, Edgar L. and Zach, Sarah E. Measuring Training Effectiveness- Procedural Versus Combat Proficiency. Paper presented at the meeting of the Military Testing Association, October 1979.
164. Siller, William O. Development Test II (PQT-G) of Multiple Integrated Laser Engagement System (MILES). Material Testing Directorate, Aberdeen Proving Grounds Final Report, February 1979.
165. Skinner, Michael. Red Flag. Presidio Press, Novato, California, 1984.
166. Stein, Earl S. and Erwin, Donald E. Air Ground Engagement Simulation (AGES): Realistic and Effective Train'g for Air Defense Personnel, Proceedings of the First Interservice/Industry Training Equipment Conference, Technical Report 1-H-316, Naval Training Equipment Center, Orlando, Florida, November 1979.

167. Stein, Earl S., King, Francis, Sevilla, Exequiel and Seed, Richard. "MILES Realistic Training for Direct Support Artillery," Field Artillery Journal, Volume 48, Number 5, September-October 1980, pp. 45-47.
168. Stein, Earl S., Sulzen, Robert H. and Jones, Donald R., Jr. The Training Effects of Board Game Combat Simulation on Tactical Unit Field Performance. Paper presented at the meeting of the North American Simulation and Gaming Association, San Antonio, Texas, October 1979.
169. Stout, Michael A. "Squad Leaders Combat Laser Course," Soldiers, Volume 2, Number 1, Fall 1982, pp. 44-45.
170. Stromvall, Steve. "The Real Thing," Soldiers, Volume 33, Number 2, February 1979, pp. 9-11.
171. Sulzen, Robert H. The Effects of Repeated Engagement Simulation Exercises on Individual and Collective Performance. ARI Technical Report 485, August 1980.
172. Sulzen, Robert H. (Ed) Unit Performance Measurement: Proceedings of the ARI Sponsored Seminar, 6-8 October 1981. ARI Working Paper SS/TA-82-1, May 1982.
173. Sulzen, Robert H. and Bleda, Paul R. Effects of Combat Simulation on the Work-Related Motivation/Satisfaction of Participants, ARI Technical Paper 351, March 1979.
174. Sulzen, Robert H., Hannaman, David L., Freeble, Jerome D., Jr. and Laurence, Michael T. Combat Operations Training Effectiveness Analysis Model (COTEAM) Applied to Rifle Squad and Platoon Evaluation. ARI Working Paper SS/TA-81-1, August 1981.
175. Sulzen, Robert H., Laurence, Michael T. and Hannaman, David L. Developing Military Proficiency in Army Tactical Units through Repeated Engagement Simulation Exercises. Paper presented at the meeting of the American Educational Research Association, New York, March 1982.
176. Sulzen, Robert H. and Root, Robert T. Engagement Simulation: Development of an Innovative Training System. Paper presented at the Annual Meeting of the American Educational Research Association, New York, April 1977.
177. Sulzen, Robert H., Root, Robert T. and Epstein, Kenneth I. Development of an Evaluation Model and Training Program for the Multiple Integrated Laser Engagement System (MILES) Phase I. ARI Research Program Review 76-7. October 1976.
178. Sulzen, Robert H. and Stein, Earl S. Measuring Training Effectiveness in Units: That Elusive Goal. Paper presented at the meeting of the American Educational Research Association, Los Angeles, California, April 1981.

179. Sulzen, Robert H., Stein, Earl S. and Jones, Donald R., Jr. The Effects of Two Leader Tactical Training Techniques on Rifle Platoon Performance. Working Paper SS/TA-80-2, August 1980.
180. Sulzen, Robert H., Word, Larry E. and Loftis, Donald D. A Tryout of Engagement Simulation Training Techniques for Rifle Squads and Platoons. Working Paper SS/TA-80-1, June 1980.
181. Sutterlin, Walter J. "REALTRAIN," Infantry, Volume 69, Number 5, September-October 1979, pp. 35-37.
182. Terrill, William L. "ADA at the NTC," Air Defense Magazine, October-December 1982, pp. 8-11.
183. Thompson, Robert H. "Lessons Learned from ARMVAL," Marine Corps Gazette, Volume 67, Number 7, July 1983, pp. 36-44.
184. Tice, Jim. "Fort Irwin to Unveil New Equipment," Army Times, 17 August 1981, p.10.
185. Tice, Jim. "Safe Laser Eyed As New Tool for Tactical Training," Army Times, 8 March 1976, p. 26
186. Tice, Jim. "Trainees at Fort Irwin Face Soviet Tactics," Army Times, 17 May 1982, pp. 15 & 38.
187. Tice, Jim. "Units Found Lacking 'Go-to-War' Skills," Army Times, 7 March 1983, p. 7.
188. Tips from the Trenches, "MILES Video Tapes," Army Trainer, Volume 2, Number 4, Summer 1983, p. 47.
189. Tools for the Trainer. "MILES Training Support Materials," Army Trainer, Volume 1, Number 4, Summer 1982, p 60.
190. TRADOC Combined Arms Test Activity. Multiple Integrated Laser Engagement System (MILES) Operational Test II (MILES OT II). TACATA Final Report OT 210, May 1979.
191. TRADOC'S Program Manager for Engagement Simulation, TRADOC's Engagement Simulation Research and Development Program. US Army Combat Arms Training Board, Fort Benning, Georgia, March 1976.
192. TRACOC System Manager for Tactical Engagement Simulation. Training Circular 71-4. How to Plan, Prepare, and Conduct MILES Training. Coordinating Draft, September 1980.
193. Training Newsbriefs "Abrams Enters MILES Battlefield," Army Trainer, Volume 2, Number 3, Spring 1983, p.12.
194. US Army Armor Center and Fort Knox. Tank Weapons Gunnery Simulation System (TWGSS). Directorate of Training and Doctrine Fact Sheet, November 1983.

195. US Army Armor School. Tactical Training for Combined Arms Elements-
REALTRAIN. Training Circular 71-5, Fort Knox, Kentucky, January 1975.
196. US Army Combat Arms Training Board. TANKS (Tactical Application of a
Numerical Kill System), Fort Benning, Georgia, June 1974.
197. US Army Infantry School. Squad Combat Operations Exercise (Simulation)-
- (SCOPES). Training Circular 7-2, Fort Benning, Georgia, 1973.
198. Weaver, W. Bruce and Griesemer, H. Alan. NTC Training Performance
Analysis Tool (TPAT). Final Contract Report for ARI. Contract
Number MDA 903-82-C-0656, February 1984.
199. Weaver, W. Bruce and Griesemer, H. Alan. The Battalion Combat Outcome
Model (BCOM): A Simulation of Unit Tactical Performance on Desert
Terrain. Final Contract Report for ARI. Contract Number MDA 903-82-
C-0656, January 1983.
200. Wheaton, George R., Johnson, Eugene III, and Dondero, Larry J. Research
on Systems Analytic Approaches to Unit Evaluation: Specification of
Performance Variables and Measures for ES-Based ARTEP. Final
Contract Report for ARI, Contract MDA 903-80-C-0187, July 1981.
201. Wheaton, George R., Johnson, Eugene III, Forrester, Richard E., Dondero,
Larry J. and Sulzen, Robert H. Research on Systems Analytic
Approaches to Unit Evaluation: Interpretation of Performance Data.
Final Contract Report for ARI, Contract MDA 903-80-C-0187, July 1981.
202. Whitmarsh, Patrick J. An Assessment of Job Satisfaction of Combat Arms
Personnel During REALTRAIN Training. ARI Technical Report 597,
November 1983.
203. Wilde, Robert L. Small Force Engagement Experimentation. Report SAND
79-2473. Sandia Laboratories, Albuquerque, New Mexico, February
1979.
204. Wilde, Robert L. "Tactical Training for Security Personnel," Sandia
Technology SAND 81-1813, Sandia National Laboratories, Albuquerque,
New Mexico, Volume 5, Number 7, December 1981, pp. 16-27.
205. Wilkins, G.H. "SCOPES Training," Infantry, Volume 65, Number 3, May-
June 1975, pp. 50-52.
206. Wilson, Michael W. "Simfire -- Tank Gunnery and Tactical Simulation,"
National Defense, Volume 64, Number 358, February 1980, pp. 28-31.
207. Wolf, Don H. "Dragon Gunners Score with MILES," Army Trainer, Volume
1, Number 4, Summer 1982, pp. 38-40.
208. Word, Larry E. Independent Evaluation Plan for Operational Testing of
Multiple Integrated Laser Engagement System (MILES). TRADOC Systems
Manager for Tactical Engagement Simulation, Coordinating Draft,
February 1978.

209. Word, Larry E. "Observations on the Use of TACTA WESS Device in Brave Shield XIV," Memorandum for BG Pearson, TRADOC, September 1976.
210. Word, Larry E., Loftis, Donald D., and McQuitty, John T. "Enhancing Combined Arms Training," Field Artillery Journal, Volume 46, Number 4, July-August 1978, pp. 51-53.
211. Word, Larry E. and Root, Robert T. Tactical Engagement Simulation: Experiential Learning. Army Training Support Command Pamphlet, June 1977.
212. Zuclich, Joseph A., Tredici, Thomas J., Mikesell, George W., Gibbons, William D. and Schmidt, Robert E. MILES Device Ocular Hazard Evaluation. USAF School of Aerospace Medicine Report SAM-TR-80-2, Brooks Air Force Base, Texas, March 1980.